Messages from the Outgoing and Incoming Presidents

I have thoroughly enjoyed my year as President of SSPC. It has been an honor and privilege to serve as the Board Chairman and to be a part of such a caring and giving group of people who sacrifice their time and resources to provide the long-term guidance and direction needed to move the organization forward. The Board remains dedicated to giving SSPC members value for their dollar and the programs and services they want, and, most of all, deserve. Work is hard enough, and an association's job is to make it easier for its members.

SSPC training continues to serve the needs of our industry. The training curriculum and the instructors who present our courses are second to none. SSPC training is among the best education people can receive, whether they have been in the industry for years or they are just starting their careers in coatings. We have launched the Project Manager course and have other courses in the pipeline to support our members and others in the industry.

Our certification programs are also first class, whether they are company focused or designed for individuals. A record number of owners now specify SSPC-QP programs, thus raising the bar in the coatings industry.

As reported in the April 2009 *JPCL*, we remain a strong and stable organization. This is due to the diligence, oversight, and management of the SSPC Board of Governors and the SSPC staff. The Board is always amazed by the capabilities of the staff. They are few in number but deliver so much. I participate in numerous groups and associations, and there are no finer and caring personnel out there. I am deeply grateful for the support they give the membership, the Board, and me.

We continue to listen to the members, who told us that PACE was a noble endeavor, but it did not accomplish what we as a society wished to promote, and it diluted the message SSPC wanted to send, and thus the overall SSPC mission. That message is that the use of high-performance industrial coatings is critical and is the most commonly employed means of corrosion control. For that reason, the Board decided to end our relationship with the PDCA after PACE 2010 and return to our own conference in 2011. The Board and I have only the utmost respect for the leadership, staff, and members of the PDCA, and we are sure there will be continued cooperation between both societies in other endeavors. The Board and I still believe that a mega-coatings show is the way of the future. We remain focused on this goal. We need the memberships of other associations to push their leadership toward that goal, especially during the downturn in the economy that we are now experiencing.

As I leave my year as the President of this society, I want to reiterate that we are in a very solid position. I would like to thank the Board, the members, and the staff for their support during this most enjoyable year.

J. Bruce Henley
The Brock Group
SSPC Immediate Past President

I am honored to be the next SSPC President. I have been a member of this organization for 25 years and have been on the SSPC Board of Governors since 2000, when I was appointed to fill the unexpired term of my mentor, Crone Knoy.

Crone got me involved in an association that makes every attempt to give back to the industry, and I am now privileged to lead such an organization. I have seen the association grow and prosper, but we have a long way to go. I am sure that the Board will continue to do its best to listen to the "Voice of the Customer," our members. The application of high-performance coatings involves not just painting. The science and the art of their application require knowledgeable individuals who have training and education, and SSPC remains focused on training that raises the bar in the industry. The Board and I will continue to ensure the staff gives you the information you need in a very timely manner to make your hectic work requirements and your job easier.

I am looking forward to seeing you at the final PACE conference in Phoenix, AZ, in 2010. One of the true values of an association is the networking opportunities provided by meetings and gatherings. I am excited to begin working with the Board and staff to continue to move SSPC forward and to ensure that we never lose our core requirement of customer focus. Thank you.

Steve Roetter, PE
Tank Industry Consultants
SSPC President

Michael T. Hartings

PPG Appoints GM for U.S. and Canada

PPG Industries has appointed Michael T. Hartings as general manager of the protective and marine coatings (PMC) business in the U.S. and Canada. Hartings has been with PPG since 1992; his previous position was general manager of PPG Coatings Malaysia. He will relocate from Kuala Lampur, Malaysia, to PPG's corporate headquarters in Pittsburgh, PA.

PPG is a global supplier of paints, coatings, chemicals, and more. PMC supplies protective and marine coatings for a wide variety of projects in energy, infrastructure, and marine markets.

Revised ISEA Standard Now Available

The International Safety Equipment Association (ISEA) has received American National Standards Institute (ANSI) approval for ANSI/ISEA Z308.1-2009, American National Standards—Minimum Requirements for Workplace First Aid Kits and Supplies.

The standard is a revision to the 2003 edition and was prepared by the members of ISEA's Industrial First Aid Group, along with others in the industry. Updated topics include the designation of new kit types, expansion of the required supply list to include a first aid guide, and redesign of the product label.

Copies of the standard are available from ISEA headquarters at 1901 N. Moore St., Ste. 808, Arlington, VA 22209.

U.S. Gov't Launches Online Public Forum

The eRulemaking Program, a federal-wide E-Government project led by the U.S. Environmental Protection Agency (EPA), has launched an online public forum, Regulations.gov Exchange.

Regulations.gov is an online source for citizens to search, view, and comment on regulations issued by the U.S. government. The recently launched Exchange page gives citizens a chance to post opinions about the web site and engage directly with other users and eRulemaking program staff. The Exchange will be open for public participation from May 21–July 21, 2009.

Regulations.gov Exchange aims to promote public engagement by involving citizens in the development of a major government web site and to enhance the transparency of government decision making.

In 2008, Regulations.gov received more than 110 million hits and 450,000 comments on regulations. It holds 2 million documents from more than 160 federal entities.

Visit www.regulations.gov/exchange for more information.

Dur-A-Flex Offers a Contractor Academy

Dur-A-Flex, Inc. recently held its first session of its new Contractor Academy for Owners, a program for owners of independent commercial floor contracting firms.

The curriculum addresses management styles, profitability, and financial strategies for a successful job site. There are also exercises in pre-planning and post-job analysis to help find hidden profits and problems.

For details, go to www.duraflexuniversity.com.

WJTA Plans Conference and Expo

The WaterJet Technology Association (WJTA) will hold the 2009 WJTA Conference and Expo August 18-20 at the Marriott Westchase Hotel in Houston, TX. The conference will focus on sharing information about technology, best practices, and safety.

On August 18, there will be two pre-conference workshops. Waterjet Technology: Basics and Beyond will discuss flash rust, surface preparation, equipment, and more. Recommended Practices for Industrial Vacuum Equipment will cover the dangers of the vacuum and safety precautions. There will be live demonstrations throughout August 19 and 20, including paint and coating removal, concrete preparation, and industrial cleaning. Also on those two days, there will be an expo and "boot camp" sessions discussing what the industry expects of contractors.

For a complete schedule and more information, visit www.wjta.org.

PaintSquare Webinars Debut

Nearly 300 people registered for "Cool Roofs, Cool Coatings: Energy Efficiency When the Heat is on," PaintSquare's first webinar, which was held June 11, 2009. The online home of *JPCL*, paintsquare.com is part of the portfolio of Technology Publishing (Pittsburgh, PA).

Webinar presenter Andre Desjarlais—who is the group leader of Building Envelopes Research at Oak Ridge National Laboratory—defined and discussed types of cool roofs, described energy savings resulting from their use, and fielded questions from participants. A recording of the program can be viewed on the *Journal of Architectural Coatings (JAC)* website, jacjournal.com., and on paintsquare.com. *JAC* is a sister publication of *JPCL.*

The next PaintSquare webinar, scheduled for 2-3 p.m. on August 20, is "Air-Barrier Systems for Sustainable Masonry Walls," presented by Chris Bupp, architectural and educational services, Hohmann & Barnard. The program is free at jacjournal.com or paintsquare.com. Registration is available at either website.

For more information, go to www.paintsquare.com.

American Coatings 2010 Call for Papers

Papers are invited for the American Coatings Conference 2010, to be held April 12-14 with the American Coatings Show, April 13-15, in Charlotte, NC. NPCA|FSCT and Vincentz Network are the joint hosts. Abstracts are due September 15, 2009.

For details, visit www.american-coatings-show.com/callforpapers.

From the Publisher of *JPCL:* Daily Paint News on Your Desktop

Or on your laptop, pda, or cell phone. PaintSquare News, a free daily e-newsletter packed with timely coating information for the protective & marine, commercial, and residential sectors, will arrive in electronic inboxes starting July 20, courtesy of Technology Publishing, which publishes *JPCL*, PaintSquare.com, the *Journal of Architectural Coatings (JAC)*, *Painting & Wallcovering Contractor (PWC)*, and other coatings news products.

Each business day, readers can expect a fresh edition of PaintSquare News covering acquisitions, education, leads on coatings projects, job openings, personnel changes, regulations and standards, stock prices in the coatings industry, and more.

Readers will also be able to express their opinions through daily polls on current issues; show off their knowledge about the paint industry through a daily quiz game; and link to Technology Publishing's electronic portfolio, including Paint BidTracker, jacjournal.com, paintstore.com, and paintsquare.com (the online homes of *JAC*, *PWC*, and *JPCL*, respectively).

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For information about advertising, contact Rick Vaccarelli, Vice President of Sales, rvaccarelli@paintsquare.com.

Minimizing Coating Systems for Exterior Exposures in Chemical Plants

Mark Weston, Incospec & Associates

If you want to minimize the types of coating systems for atmospheric service in a chemical plant, what would be the best system to cover most exposures?

There is no universal protective coating system that will accommodate all exposure environments. I would use the following as a broad-spectrum protective coating system.

In this PSF scenario, we can assume the exposure will include chemicals ranging from low to high pH, oxidizing and reducing agents, possible spills of hydrocarbons, and exposure to UV. We assume the substrate is mild steel.

The primer coat needs good wetting out and passivating properties. Because the pH of the environment may vary between acidic and alkaline, we cannot use any of the sacrificial primers such as zinc. Instead, an epoxy zinc phosphate should be applied over a suitable and prepared surface to a minimum dry film thickness (dft) of 2 mils (50 microns). It should be noted that zinc phosphate is quite a different material than zinc.

The intermediate (or build) coats need to form a barrier between the environment and the primed substrate to prevent the ingress and permeation of water vapor and other products. The build coat must also stand up to mechanical damage. A combination of coating thickness and a leafing pigment, together with a well-formulated binder, is required to achieve this. My recommendation is a high-solids epoxy micaceous iron oxide (MIO) applied at a minimum dft of 10 mils (250 microns). For superior chemical resistance, select an unmodified epoxy, not a modified or surface-tolerant one. The modified ones, commonly called epoxy mastics, are fine for repairs and for poorly prepared surfaces but are of necessity a compromise product.

The color range will be limited by the MIO-pigmented coating, and the epoxy binder will also be attacked by UV exposure. The best performing topcoat to protect against UV, to add color, and to aid surface cleaning is a pure or standard polyurethane. This coating will have some occupational health and safety (OH&S) issues during application, and, generally, can only be applied in the field by roller or brush. The OH&S problem is a volatile curing agent that can be toxic when it is unreacted. [*Editor's Note: Depending on local air quality regulations, worker protection requirements, and the availability of appropriate protective gear, polyurethanes can be applied by spray. Check with all appropriate authorities about requirements for applying polyurethanes or any other coating for that matter.*]

Moreover, polyurethane is difficult to recoat. This difficulty in recoating is both its strength and its weakness. The surface is not easily attacked by other chemicals; hence, to try to get another coating to bond on top of it is difficult. Because of recoating difficulties with polyurethanes, a number of alternatives—acrylic- or epoxy-modified polyurethanes—are available. The alternatives are often marketed as recoatable, but because the recoatable products are modified polyurethanes, they do not perform as well as standard polyurethanes in chemical resistance and in UV protection. A standard polyurethane will perform the best by far of all products. In general, all the polyurethanes have an excellent color range with high gloss, which allows for easy cleaning.

The topcoat is applied to provide color retention, UV resistance, and ease of cleaning. If the main reason for topcoating is principally

Mark Weston is the technical director and one of the principals of Incospec & Associates, an Australian/South East Asia-based corrosion engineering consultancy company that has expertise in the fields of protective coatings, material selection, and cathodic protection. He is a past national president of the Australasian Corrosion Association and is the current chair of the Australian Painting Contractors' Certification Program technical committee. Mr. Weston has over 40 years of experience in the corrosion industry. He is a trainer and lectures widely on protective coatings and on corrosion-related topics, both locally and internationally.

color for aesthetics or identification, then a wide range of other products can be used. Architectural waterborne acrylics are common. They have a good color range, are single pack, and are easy to apply in the field.

The following is my recommendation of a general-purpose coating system for chemical exposure.

- Clean the surface to SSPC-SP 10/NACE No. 2 (Near-White), ISO 8502 class Sa 2.5, with a profile of 1.5 to 2.5 mils (35 to 60 microns).
- Apply a primer coat of an epoxy zinc phosphate to a dft of 2 to 3 mils (50 to 75 microns).
- Apply a build coat of a high-solids MIO epoxy to a dft of 10 mils (250 microns).
- Apply a topcoat of a standard polyurethane to a dft of 2 mils (50 microns). A modified or re-coatable polyurethane may be used instead (see notes above).

This recommendation is for a new or replacement protective coating system. A repair coating or a coating for poorly prepared surfaces is quite another topic altogether.

Wim Bonestroo, Rotterdam Painting Consultants

In a chemical plant, coating systems may differ depending on their specific use. One of the most common parameters, for instance, is temperature exposure. Exposure to elevated temperatures requires the use of specific coatings that are not suitable for "normal" atmospheric exposure.

If we, however, consider normal atmospheric conditions up to a maximum temperature of 90 C (194 F), a three-coat system consisting of three coats of (the same) surface-tolerant epoxy with a dft of approximately 80 microns (3.2 mils) per coat would probably be the most versatile system to use. We know from testing as well as from practical experience that the wet-

Continued

ting properties of these products make them suitable for use on previously painted (hand- or power-tool-prepared) substrates and that the products also perform well on (Sa 2.5) blasted steel. We have been evaluating the practical performance of a number of surface-tolerant systems applied on Sa 2.5 blasted steel over six years. One of the parameters evaluated was the propagation of corrosion from a scribe. We found that the performance of the evaluated surface-tolerant systems matches and sometimes even outperforms zinc-rich epoxy systems.

In case a more durable and UV-resistant finish is required, a polyurethane topcoat could be used.

It is important to mention that the use of so called "winter grade" surface-tolerant epoxy products should be restricted to actual low temperatures only. The winter grade versions are sometimes used in shop applications (at normal temperatures) because of their faster drying and curing properties. Application at normal temperature, however, reduces the wetting and adhesion of the product to the substrate and will therefore reduce its corrosion resistance.

Another word of warning with regard to re-coating—the maximum re-coat time is often specified as "unlimited" or "extended." We have found that, depending on many unpredictable and uncontrollable circumstances (e.g., temperature and UV exposure), re-coat times are sometimes all but unlimited and that problems occur with the adhesion of the subsequent coat. When an uncontaminated coating layer is overcoated within approximately one week, the recoat window should not be problematic.

Wim Bonestroo began his career in 1983 as a technical service representative with Hempel Paints in Saudi Arabia. In 1985, he joined Fortis Coatings in the Netherlands as a technical service technician, responsible for the evaluation, modification, and introduction of new products. From 1993 to the present, he has been employed as technical manager by RPC (Rotterdam Painting Consultants), which provides services that include coating inspection and surveys, training, and coating maintenance strategies for infrastructure, petrochemical, industrial, and offshore clients. Mr. Bonestroo is a NACE-certified coating inspector and a NACE CIP instructor.

Got Questions?

Send them to Karen Kapsanis, Editor, *JPCL*, at kkapsanis@protectivecoatings.com.

You can also find past Problem Solving Forum questions and answers dated from 1995 through the present at www.paintsquare.com, *JPCL's* electronic home.

The Case of Hurry Up and Wait...

Premature Rusting of Newly Coated Structural Steel in a Chemical Plant

By Bruce Rutherford, Operations Manager, KTA-Tator, Inc.
Richard Burgess, KTA-Tator, Inc., Series Editor

Chemical plant engineers and coatings specifiers recognize that the economic service life of a coating system begins when fabricated steel is prepared and painted before erection. Facilities today are installing coatings based on well-defined requirements, including higher degrees of surface preparation, coating systems with improved corrosion and chemical resistance, and quality assurance and quality control inspections during the work. As a result, the expected economic service life of coating systems in chemical plants has increased. Coupled with these changes are overall process and environmental improvements in chemical facilities that help mitigate extreme exposures to harsh acids, alkalis, and other detrimental fumes that in years past significantly reduced the time before coating maintenance or replacement was required. Despite the improvements, performance does not always meet expectations, and anticipated service lives are not always achieved. Sometimes even months after the installation is complete, premature failure can lead to overall changes in a facility's approach to maintenance painting.

Fig. 2: Steel supplied by the North Central fabricator developed pinpoint rusting on the primer. The dry film thickness ranged from 2.0 to 4.9 mils.

Fig. 1: Typical construction damage evident on exterior exposed steel components. Surface rust and dirt can be seen on the lower flange. Photos courtesy of the author

This article describes a project that included many well-intended steps, such as inspection and documentation, with coatings recognized as an important milestone in the new construction phase.

The Project: Design, Specifications, and Alterations

A facility owner was building a large chemical process unit in the Gulf Coast area that ultimately would contain large distillation columns, process reactors, pressure vessels, heat exchangers, pumps, piping systems, and electrical control systems. Adjacent to the unit was a multi-story control building that would house offices and electrical equipment for operating the new chemical unit. Considerable forethought had gone into the equipment layout. Designers took into account the needs of the operators and maintenance staff that would ultimately operate and maintain the unit and the control building.

The design effort included attention to materials of construction based on economic assessments of corrosion resistance and expected service life. Ultimately, a strategy was formed for painting the equipment components, piping, and structural steel, whereby much of the work would occur in the controlled conditions of fabricator and painting facility shops before erection. All of the coating work was to be inspected by the company's engineers before shipment to the project site. Field painting was to be limited to field-fabricated piping, handrail, weld repairs, and touch-up of construction damage (Fig. 1). The steel and equipment components were scheduled for sequenced delivery, with erection immediately upon arrival because of the tight schedule and limited space for storing the components at the site.

The company specification for the steel components of the control building required an SSPC-SP 6, Commercial Blast Cleaning, with a surface profile of 1.0–2.0 mils. Also specified was application of a high-build epoxy primer at 2.0–4.0 mils dry film thickness (dft). An additional coat of the same high-build epoxy was specified for steel not exposed to weather. For steel exposed to weather, the specification called for one coat of an aliphatic two-component polyurethane finish coat at 2.0–4.0 mils over the high-build epoxy primer. The specifications for the process unit steel were much more stringent, involv-

ing both higher degrees of surface cleaning (SSPC-SP 10, Near-White Blast Cleaning) and multiple coats of corrosion-resistant coatings, including an organic zinc-rich primer, a high-build epoxy intermediate, and a polyurethane finish coat on ambient surfaces to 200 F and other high-performance coatings on both hot and cold operating surfaces. The company had also developed a color coding system based on the contents of piping components and had standardized the finish coat colors for the control building, the process unit structural steel, and the process equipment. Steel surfaces were prepared in the shop with recyclable steel shot and grit.

Schedule constraints quickly developed as the project moved from the design engineering stage to the construction stage. Structural steel fabricators local to the project were backlogged, and the general contractor for the project elected to use more remote fabrication facilities in the northern Unites States to meet the tight delivery schedule. One of the two major steel providers was in the North Central U.S., and the other was in the New England area. Adjustments to color requirements were also made as the project progressed to more quickly complete shop fabrication and painting of the equipment and structural steel.

Most of the steel was painted between mid-January and mid-March, and then trucked to the jobsite. Trucks reached the jobsite approximately two days after the painting was completed. Because the coating work was distant to the project site, the original plan for company engineers to inspect the coated steel before shipment was waived; only one inspection had been performed at the New England shop. As the schedule began to slip further in early February, the construction manager decided that approximately two thirds of the process unit and control building steel would only be prime coated at the fabricators' shops. The construction manager thought the project could be brought back on schedule by saving fabrication shop time and applying the topcoats in the field while other construction activities continued at the site.

Inspection reports by the North Central fabricator indicated prolonged drying times were required for the epoxy primer specified for the control building steel. Ambient temperatures during application and curing ranged from 65 to 71 F, and surface temperatures ranged from 63 to 67 F. The epoxy primer remained soft and tacky and could not be handled for at least 24 hours and up to 48 hours following application. As a result, the fabricator contacted the coating manufacturer's local representative, who recommended an addition of three fluid ounces of accelerator additive for each gallon of the mixed product to reduce drying and curing times. Based on the inspection reports, the accelerator appeared to remedy the problem of extended drying times, and steel was again shipped from the shop on schedule. The New England shop did not report issues with the drying times.

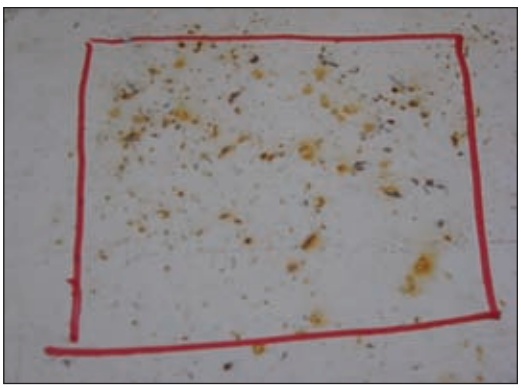

Fig. 3: Rust staining on horizontal steel surfaces with primer applied at dry film thickness ranging from 4 to 8 mils, also from the North Central fabricator.

In the spring of that year, company engineers noted that some of the control building steel members supplied by the North Central shop showed pinpoint rusting (Fig. 2) and were yellow compared to steel provided by the New England shop. As a result, an investigation was launched to examine the coating problem, determine the cause, and recommend repair methods.

Site Investigation

The field investigation involved a visual examination of rusting and non-rusting coatings, non-destructive coating thickness measurements, adhesion testing, surface profile measurements, sample procurement, and photographic documentation of the observations. In addition, the investigator reviewed the company specifications, paint product data information, and inspection reports from both fabricators.

SSPC-VIS 2, "Standard Method for Evaluating Degree of Rusting on Painted Steel Surfaces" was used as the basis for quantifying the visible rusting. The visual assessment revealed that the distribution and concentration of pinpoint rusting ranged from Rust Grade 9-P (0.03%) to Rust Grade 3P (16%). Rusting was visibly more concentrated on areas where moisture accumulated (i.e., pockets, horizontal surfaces) or where the pattern of surface dirt and grime indicated that the steel faced upward during shipping or storage. A significant amount of damage had occurred from shipping, handling, and erection, including small to large nicks, scrapes, and gouges. The steel members supplied with the accelerator-modified primer exhibited a yellow tint that was not apparent on steel coated without the additive. The damage and rusting were much more prevalent and widespread on the primer that incorporated the additive, but not exclusive to it.

A significant amount of fine metallic dust had also accumulated on the painted steel surfaces. The dust had rusted and created considerable rust staining. Under magnification, larger imbedded

Continued

rust globules were also visible in isolated areas within the primer, with the pinpoint rusting more concentrated in these isolated areas. Weld spatter had also been coated over and was rusting as the coating had drawn thin at these protrusions.

Coating thickness was measured on accessible structural steel members. Measurements were taken in areas exhibiting various concentrations of pinpoint rusting as well as areas exhibiting no evidence of rusting. Measurements were taken on coated steel members supplied by both fabricators and on steel coated both with and without accelerator.

Areas with concentrated rusting were also areas where the primer included the use of the accelerator. The coating thickness ranged from 2.0 to 4.9 mils (Fig. 2), averaging 3.5 mils. Areas of primer with the accelerator but with less concentrated rusting revealed thickness ranging from 4.0 mils to 8.0 mils, averaging 6.1 mils (Fig. 3, p. 13). Areas with less concentrated rusting that did not use the accelerator exhibited coating thickness ranging from 2.0 to 5.5 mils, averaging 3.2 mils. In areas where the primer was free of pinpoint rusting and accelerator was not used, the thickness ranged from 3.0 mils to 8.5 mils, averaging 7.0 mils.

The adhesion of the primer was measured in accordance with ASTM D3359, Method A (X-cut), "Measuring Adhesion by Tape Test." Adhesion testing confirmed that consistently good adhesion existed on both accelerated and non-accelerated primer with values of 4A and 5A (on a scale of 0A to 5A, with 5A being the best).

The surface profile was measured on steel members prepared by both fabricators, on members that were rusted/non-rusted, and on members representing primer both with and without the accelerator. The profile was measured in accordance with ASTM D4417, "Standard Test Methods for Field Measurement of Surface Profile of Blast Cleaned Steel," Method C (Replica Tape). In each test location, the primer was completely removed with a chemical stripper. Surface profile consistently averaged 2.0 mils, despite inspection reports from both fabricators indicating both higher and lower profile measurements. The visual appearance in the sample areas appeared to be consistent with the requirements of SSPC-SP 6.

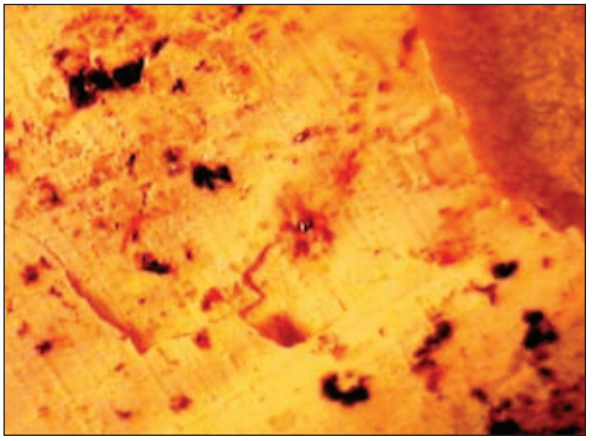

Fig. 4: Sample KTA-3, viewed at 40X magnification, shows the appearance of pinpoint rusting of primer modified with curing accelerator.

Primer samples were removed from steel supplied by both fabricators. Samples included accelerated and non-accelerated coatings, with rusted and non-rusted areas. Twelve samples were collected.

Laboratory Investigation

The laboratory investigation consisted of visual and microscopic examinations. Metallic fines were present on the backside of all of the samples, including samples representing each shop, accelerated and non-accelerated primer, and good adhesion. When viewing rusting samples of the accelerated primer at 40X magnification, investigators saw that many of the pinpoint rust spots were very small, blister-like projections in the coating with microscopic cracks that emanated rust. The metallic particles trapped beneath the coating had rusted, expanded, and increased in volume. The expansion caused the coating to crack, and pinpoint rusting resulted (Fig. 4).

The samples of non-accelerated coating did not exhibit the above condition, and with very little rusting present, the samples indicated that the non-accelerated coats provided better corrosion resistance than the coats with the accelerator. Thickness variations noted in the field investigation were confirmed in the laboratory evaluation. Thickness seemed to have a direct influence on the degree of rusting on the accelerated coating. Samples of accelerated coating with lower thickness and subjected to ponding water conditions exhibited a higher concentration of rusting, while the accelerated primer with a higher thickness, also subject to ponding water, exhibited less rusting.

The metallic fines beneath the primer without the accelerator did not manifest pinpoint rusting. Microscopic examination confirmed that the outer surface of these coating samples was contaminated with metal fines (dust) that had rusted and that the rust staining was a surface phenomenon only. Rusting of metallic fines on the steel substrate did not occur; and therefore, there was no cracking of the coating.

Summary of the Failure Analysis

Fabrication shops commonly use recyclable metallic grit and shot for their abrasive blast cleaning process. Even when the surface of the steel is thoroughly cleaned by compressed air or even vacuuming prior to application, a residual amount of metallic fines, commonly referred to as "smut" can remain on the metal substrate. The very fine particle residues are produced as the steel abrasive, mill scale, and rust are fractured during the blast cleaning process. The smut is believed to cling to the steel surface by magnetic or electrostatic attraction.

Under ordinary circumstances, because of their microscopic size, the metallic fines are incorporated into the coating with no detrimental effect. In the case of the accelerated primer, however, the coating was susceptible to damage from corrosion of the metallic particles in the film which occurred at lower thickness (albeit within the 2.0 to 4.0 mils specified), and when exposed to ponding water conditions. Heavier thicknesses (twice the specified thickness) were more resistant to corrosion of the particles under the same exposure conditions. In contrast, the non-accelerated coating performed well under the specified application thickness and same exposure conditions.

The surface rust staining (Fig. 5) was unrelated to accelerator use and is common on construction projects with crafts working at multiple elevations grinding steel components. The steel fines generated during grinding accumulate on horizontal surfaces, especially in pockets, and rust when exposed to dew and rain. While not harmful to the underlying coating, they create a performance problem when coated over and an aesthetics problem if present on the finish coat. When field coats are to be applied, the surfaces should be cleaned before painting, normally by scraping, solvent cleaning, and perhaps mechanical abrasion.

While there were a variety of contributing factors in this case, the use of the accelerator is the primary reason for pinpoint corrosion through the film. The precautions regarding the use of the accelerator that were published in the manufacturer's data sheet were manifested in this project: decreased flexibility and impact resistance (contributing to a greater amount of shipping, handling and erection damage), yellowing when exposed to UV, and most significantly, reduced corrosion resistance. Any time a coating formulation change is made (such as the addition of the accelerator), the potential effect on the performance characteristics of the coating must be carefully considered before proceeding. The rusting in this case was detected during construction. Often, however, such failures aren't detected until months or years after construction, when the pressures imposed by the schedule, and the changes made to accommodate it, are long forgotten.

Fig. 5: Metallic residues from grinding operations collected in horizontal pockets that also collected water resulting in surface pinpoint rusting.

Recommendations

The owner's immediate reaction to the findings was that all rusted areas should be completely abrasive blast cleaned and reprimed. It was ultimately decided, however, that complete removal and repriming was not a practical approach because so many other crafts were working at the site and start-up was imminent. In addition, much of the steel would be concealed by the building façade. The steel that was exposed to the environment was considered a small amount in comparison to the total project.

The investigator suggested preparing all steel surfaces using LPWC, "Low Pressure Water Cleaning," or HPWC "High Pressure Water Cleaning," per SSPC-SP 12/NACE No. 5 ("Surface Preparation and Cleaning of Steel and Other Hard Materials by High- and Ultrahigh-Pressure Water Jetting Prior to Recoating") followed by power tool cleaning of pinpoint rusted areas in accordance with SSPC-SP 11, "Power Tool Cleaning to Bare Metal," and the application of one coat of primer at 2.0 to 4.0 mils. Areas with surface rust staining would likewise be pressure washed followed by spot cleaning in accordance with SSPC-SP 3, "Power Tool Cleaning" or SSPC-SP 2, "Hand Tool Cleaning." Application of one coat of high-solids epoxy primer at 2.0 to 4.0 mils followed by one additional coat of high solids epoxy on the non-exposed (interior) steel or one coat of aliphatic polyurethane topcoat on exposed (exterior) steel would then complete the work. Ultimately, the owner's representative agreed to the recommended approach, and, after several years, none of the repaired or other coatings on the project have failed prematurely.

In summary, even with the best designs for achieving long-term corrosion protection, things can and will go off-course, especially when scheduling pressures suddenly drive the process. In this case, the owner's engineering and construction management staff learned some valuable lessons that they will no doubt implement on subsequent projects.

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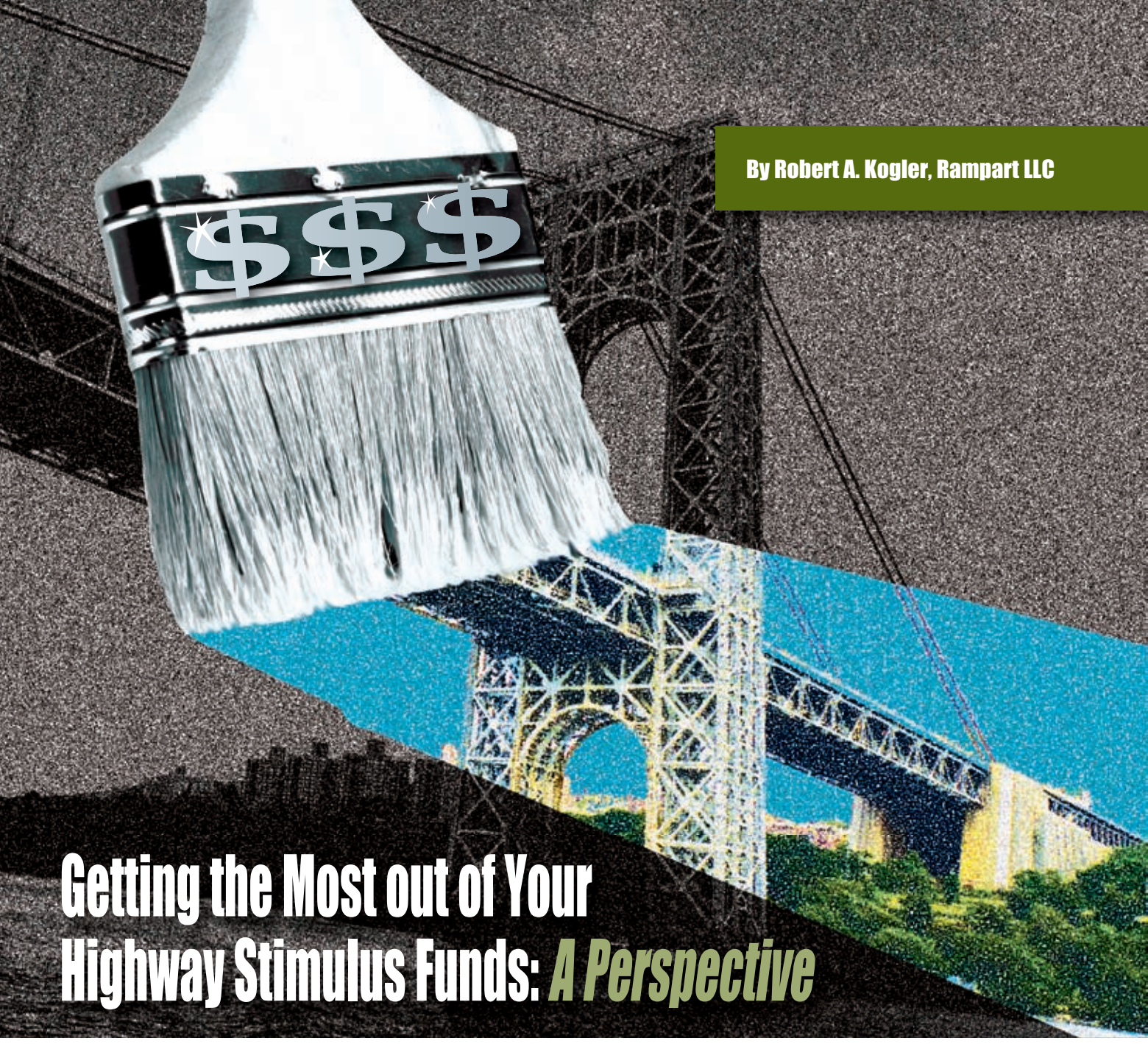


Getting the Most out of Your Highway Stimulus Funds: *A Perspective*

By Robert A. Kogler, Rampart LLC

It looks as though 2009 will be tagged the "Year of the Stimulus" within the context of public infrastructure painting. As it appears now, the general state of the economy, coupled with the elevated profile of our deteriorating infrastructure, has produced a dose of legislative steroids to get things rolling again in bridge maintenance work.

A quick scan of the newly transparent public accounting of spending shows that several states have leaned heavily on their deferred inventory of maintenance painting projects to fulfill the "shovel ready" requirements associated with the stimulus money. New Jersey has allocated at least $37 million for repainting of 90 bridges along its interstate highway corridors.[1] Washington has allocated $47 million, including $12.5 million directly from the stimulus, for the repainting of the Lewis & Clark Bridge.[2] Kentucky has allocated $16 million for painting work on the Roebling Bridge.[3] Other states have also

used the stimulus as an opportunity to dust off and roll out deferred maintenance painting projects.

To put some perspective on the current stimulus funding, it is useful to examine it through the lens of normal highway funding levels. Some $27 billion of the $787 billion stimulus plan is targeted for highway infrastructure spending. Given the extended play the deteriorating infrastructure issue received during the 2008 campaign, this number comes as a major disappointment to highway owner and user groups.[4,5] However, it does represent a substantial sum relative to normal levels of spending. The present Federal authorizing legislation, nicknamed TEA-LU, allocates approximately $40 billion per year for highway spending, so the stimulus package can be practically viewed as a "boost" of about ⅔ of an extra year. Hopefully, this one-time boon will translate into longer-term momentum over the next several years with follow-on increased annual funding levels for infrastructure rehabilitation.

The long-term significance of this boost will likely be determined by actions Congress takes over the next several months. TEA-LU runs out in September 2009. Its replacement bill is expected to raise funding levels for highway reconstruction. These reauthorization bills, however, are traditionally politically contentious and late in arriving; if these trends hold, any boost gained from the stimulus could be ameliorated by the specter of operating under the reduced spending conditions of a continuing resolution—an extension of the old legislation. From an owner's perspective, the only real course of action is to use the current stimulus windfall to get ahead of the maintenance curve and plan for the arrival of additional reauthorized funds (hopefully) within the next year.

So, other than the obvious short-term boost these actions provide to our industry, what other issues does this wave of work raise? Also, how should owners approach this windfall of maintenance dollars from a cost-benefit perspective?

Fig. 1: Increasingly, bridge painting is done using mobile platforms with temporary lane closures. Courtesy of New Hampshire DOT

Quality vs. Speed

Much of the effort of our technical community over the past decade has targeted the issue of quality. We've worked cooperatively to raise the bar with national programs aimed at obtaining better and more consistent paint materials (American Association of State Highway and Transportation Officials' National Transportation Products Evaluation Program); a higher standard of contract painting work (SSPC's Painting Contractor Certification Program); and more informed and consistent inspection (SSPC's Protective Coatings Specialist, Bridge Coatings Inspector, NAVSEA Basic Paint Inspector, and Protective Coatings Inspector programs). These quality gains have been hard fought, and certainly difficult to obtain within the low-bidder environment of public work, but there is no doubt that our community has responded and cooperated to achieve higher standards in all of these areas.

Another trend that is impossible to ignore is the irresistible push for speed in the work we do. Speed to complete a job has always been a driver for contractors because weather limits work days in many environments and the cost of labor and equipment make speed a make-or-break factor to contractors' very survival. But in recent years, speed has also become a major driver for the owner side of the equation as well. The increase in on-road maintenance work that has accompanied the increasing maintenance demands of the aging infrastructure has produced what the traveling public perceives as a blight of orange cones on their highway experience. The trend toward fast work is not merely a public relations dilemma; the

Fig. 2: Selective corrosion and paint failure under a leaking joint. Photo courtesy of the author

managers of our highway system are also pressured by serious concerns over traffic congestion to the point where lane closures brought on by maintenance are viewed as system downtime, conflicting with the basic job of the highway department to maintain mobility of the traveling public.

Our industry has responded to these challenges. An increasing number of bridge painting jobs are being performed at night or during off-hours, with work done rapidly or with mobile equipment, which requires far fewer "permanent" lane closures than work in the past (Fig. 1, p. 17). Once a job mobilizes, the work is getting done faster. Faster work meets overall facility availability goals but puts significant pressure on quality work practice and assurance functions that are essential to the job. In many ways, speed is the enemy of quality.

The stimulus raises the issue of speed in a different context. For stimulus funds, speed is an essential element of "getting the work out the door." The mandate accompanying the stimulus money is to obligate the funds within 120 days. The mandate dictates the use of the so-called "shovel-ready" projects for these funds. In practical terms, projects that either are in progress or do not require major design or environmental approval efforts are first in line for the money. Maintenance painting of bridges falls squarely into these parameters; however, the danger in this approach to rapid administration of highway work lies in the possibility of overlooking specific opportunities to stretch maintenance budgets by detailed prioritization of painting needs. That is, under a time-based mandate, it is simply more practical for an owner to contract for the painting of a single, large structure or for the full painting of all of the bridges along an entire highway corridor. While there is nothing wrong with this approach—and it captures the much-needed resources for painting—it does not address infrastructure needs based on the condition of a structure.

There are concerns associated with this "found money." Our industry has been slogging along incrementally for the past several years. Managers and planners within the DOTs have done their best to inventory, prioritize, and plan work so that the maintenance burden is slowly reduced. But their best efforts have been severely hampered by the irregular nature of the highway funding streams due to the continuous series of budget delays—both the long-term authorization bills and the annual appropriations bills obligating funds have been regularly delayed.

The incremental approach has had several effects on the industry and on jobsites across the country. A skilled workforce has been difficult to establish. When work is irregular, it is difficult to achieve continuity in the contractor, engineering design, and inspector workforces essential for ensuring consistency and quality. A surge of work driven by the stimulus will no doubt highlight workforce issues. It will take a significant effort and likely a previously unseen level of cooperation to avoid a dramatic decrease in quality. One hope is that significant increases in funding for bridge painting may attract increased interest from high-quality firms that currently focus solely on private sector markets.

Preventive vs. Corrective Maintenance

Increasingly over the past decade, bridge painting work has been packaged as a subcontract item with other major rehabilitation work on a bridge. This arrangement has been driven by the increase in overall maintenance demands on our aging infrastructure, such as deck replacement, bearing repair or replacement, and bridge widening. Administratively, packaging painting within a larger project has simply made sense. Also, because many of the bridges involved with this type of major maintenance activity are old and in poor condition, the painting work can often be termed "corrective" maintenance. That is, the existing paint system has failed and is far past its useful protective life, making total repainting the only viable option.

Fig. 3: It is common for a bridge to have significant deterioration directly underneath deck expansion joints, while the remainder of the structure is in relatively good condition. Courtesy of the author

With the stimulus money and its shovel-ready requirements, there is likely to be a trend toward more paint-only work. This fact may open the opportunity for us to rethink the approach to bridge maintenance painting. Rather than focusing on the older, more deteriorated structures with a formulaic "one size fits all" total repaint approach, the found money from the stimulus may be targeted at

the many structures that are still in reasonable shape but beginning to show the early signs of paint system deterioration. These bridges are generally rated as less of a concern under our current inspection systems, which tend to focus funding toward the global condition of structures. But the bridges in reasonable condition may, in fact, be the most economical long-term candidates for investment in "preventive" maintenance, especially the bridges with specific, definable areas of deterioration relative to the whole structure.

Many of the nation's overpass structures meet the above description. They are highly deteriorated under the leaking joints, but some 10 feet away from the joints, the majority of the steel is in very good shape (Figs. 2 and 3, p. 17 and 18). Rather than deferring maintenance on these bridges until they are either so bad that the whole paint system must be replaced, or until some other major repair is necessary on the bridge (e.g., deck replacement), bridge owners could specify zone painting around the joints and rehabilitating the joints (or even simply cleaning them out in many cases) to eliminate the primary source of corrosive species (the deck drainage). In many cases, the use of maintenance funds to eliminate the source of the salt drainage and to perform targeted painting of the steel only in deteriorated areas can maximize the condition of the structure and extend the service life of the bridge.

A similar approach can work on weathering steel bridges with specific details that are underperforming. That is, if a weathering steel bridge is showing active corrosion under the joints after two decades in the field, the corrosion will not suddenly arrest itself.[6] The time to do zone maintenance painting is as soon as possible so that the active corrosion does not progress to areas where the weathering steel is properly detailed and has formed a protective oxide film.

Carrying this line of thinking to its conclusion, the responsible approach to the use of stimulus money for bridge painting work would focus on assessing the specific corrosion protection needs of each structure deemed in need of attention and focusing the work on those specific areas. Specifically, the result of this analysis should be expected to be a mixed solution set:

- full abrasive blasting and repainting for the structures that are in true need of a complete replacement of the paint system, including and especially those that are in a naturally aggressive environment;
- less aggressive surface preparation (e.g., spot blasting, UHP water blasting, power tooling) with spot priming and overcoating for structures just beginning to show signs of paint distress; and,
- a targeted program of full abrasive blasting and repainting in a zone painting approach for the many underjoint areas of overpasses that represent the most deteriorated areas of many inland structures (Fig. 4).

Fig. 4: Zone painting can focus resources on specific areas of the bridge threatened by relatively harsh micro-climates. Photo courtesy of the author

In deciding how to spend this windfall of bridge painting dollars in order to maximize benefits and put us on the right track for the boost we hope to get from the next transportation authorization bill, I recommend considering the following issues.

Risk

The next decade in the bridge community will be defined by our ability to assess and mitigate risk during the long-term ownership phase for our structures. Risk has always been a primary driver in decision making during design and construction, but during ownership and service, risk has taken a backseat to issues such as system availability and budget. For stewardship of the existing bridge inventory, risk of collapse and shutdown has been a focus only from the standpoint of imminent structural problems. Long-term risk assessment has never been the driver for inspection and maintenance. But the focus of maintenance is beginning to change. Now bridge owners are becoming more serious about the use of rational risk assessments to drive the management of their bridge systems.[7] Corrosion protection of structures takes on a more prominent engineering role when serious analysis of risk comes to the fore, and the development of a more robust menu of corrosion protection options and strategies becomes necessary to respond in a rational manner to risk measures.

From the perspective of painting,

risk assessment must consider first the structural integrity of the bridge. Painting resources should first be used to protect the areas of structures most vulnerable to corrosion that can impact their safety, service availability, or load-carrying capacity. But risk assessment must also consider the long-term cost impacts of maintenance painting decisions. Long-term cost effects bring into consideration factors such as the expected durability of surface prep/painting systems, the financial impact of system downtime (e.g., lane closures), and perhaps even tertiary issues such as the effect of the appearance of our infrastructure on public confidence.

Quality

To achieve greater productivity both in awarding and executing jobs, we cannot give in to the temptation to compromise our hard fought quality gains of the past decade, specifically, contractor and personnel certification requirements. These requirements have been implemented for good reason and have paid owners significant dividends. Certification requirements have paid off for contractors as well by collectively raising the bar in a very challenging low bidder environment.

Cooperation

Disputes on bridge painting jobsites are too common. Training, experience, and certification programs tend to reduce disputes overall by at least putting all players on the same sheet of music. Quality specifications, written in detail, also help reduce disputes. One area that can likely be emphasized more during the ramp-up period of stimulus spending is the religious use of pre-bid and pre-job conferences. These conferences have become routine in many cases but they are quite often run much too close to the vest with too little interaction and questioning of details that can potentially cause disputes. Managing expectations for both the owner and contractor holds a lot of value. Uniformity of specifications will likely have a large role in reducing disputes.

Continuity in Specifications

Over the past decade, our industry has made great strides in terms of coating material quality and contractor certification programs. These achievements have been accomplished within a cooperative environment. Another area ripe for gains with this type of approach is the area of specification continuity. Ken Trimber pitched this idea a few years ago with an excellent paper suggesting the benefits of a NTPEP-type cooperative approach for painting specifications—or, a model specification for bridge painting.[8] Its time has come. It could be established as a joint SSPC-AASHTO document, and it should be a consensus document that takes into account the points of view of the owners, the inspectors, and the contractors. Such an approach would go far toward arming the many owners' representatives on jobs who are daily put into decision making positions with only a job-specific special provision as their defense. A uniform, consensus specification would go far toward diffusing many of the repetitive disputes arising on bridge painting jobs.

A uniform, consensus specification would go far toward diffusing many of the repetitive disputes arising on bridge painting jobs.

Joints

One of the primary causes of the need to paint bridges is the extremely poor historical (and continuing) performance of bridge deck joints. Certainly, many bridge structures cross salt water or are designed close enough to a natural or man-induced source of salt that the breakdown of the paint system ensues after only several years of service. For these cases (e.g., a coastal bridge, a low overpass over a high-speed travel lane, etc.), maintaining corrosion protection is a factor in the life cycle of the bridge that cannot be (or at least, has not been) avoided.

However, the vast majority of many bridges in this country do not lie within a mile or two of the coast, within the intense airborne saltfall gradient that natural seabreezes bring. Also, most bridges that span high-speed travel lanes are at least 15 feet high, and many are higher, so the effects of the "rooster-tail" spray from trucks traveling on salt-laden roads beneath are minimized. So, why then do all of these bridges, with seemingly low "design risk factors for corrosion" exhibit premature paint failure and corrosion and thus require significant maintenance? Much of the answer lies in the inadequacy of the deck joints and drainage systems that are used on highway bridge decks. The

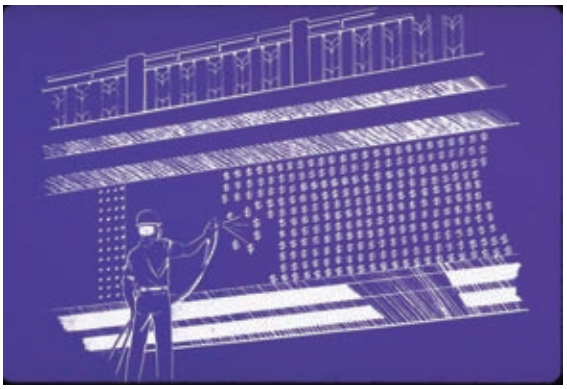
typical scene is familiar to every motorist throughout the country—a bridge that looks in perfectly good shape for 90% of its surface area, but terrible for that remaining 10%. In case after case, that 10% can be traced directly to an unintended source of concentrated corrosive contamination flowing from the deck, through a leaky deck joint or drain, and landing on the painted steel below.

Ironically, it could be argued that poor joint design and performance has led to three decades of paint development and performance testing effort. National Cooperative Highway Research Program (NCHRP) report 467 gives an excellent analysis of the issue of joints and their lack of performance.

The NCHRP report provides some hope by synthesizing the state of the practice in joint design, maintenance, and elimination of joint design problems where possible. As corrosion professionals, it is our responsibility to approach our infrastructure problem as engineers, not just materials specialists. All of us know that only a few basic approaches are useful in solving a corrosion problem. The most common approach is isolation, protecting the metal from the surrounding environment with a resistive material. That's what we typically do with paint. But there is also the more fundamental approach of elimination—removing the environmental stress that accelerates the deterioration of the structural component. That approach should be given far more attention with regard to bridge deck joints and drainage components. The payoff will be in less repetitive maintenance painting. Coupling

Ironically, it could be argued that poor joint design and performance has led to three decades of paint development and performance testing effort.

high-performance coatings with the necessary design changes and modifications to eliminate the areas of designed-in concentration of corrosive chemical is the engineering approach to make a significant, permanent dent in the growing maintenance burden for bridges throughout the country.



Paint Cost Data

Cost-benefit decision making will be a significant challenge going forward if we do not improve our system of collecting, analyzing, and understanding cost, production, and performance data in concert. We currently have the ability to develop a menu of corrosion protection and painting options that provide us with varying levels of performance. To our credit, our ability to qualitatively predict the relative performance of painting choices has sharpened. However, we still really have no idea about costs because we have not diligently collected and analyzed cost data from the work we do. As we inevitably ramp up bridge maintenance painting work over the course of the next transportation legislation, we need to make the collection and analysis of cost data a priority to maximize the benefit of our highly stretched resources.

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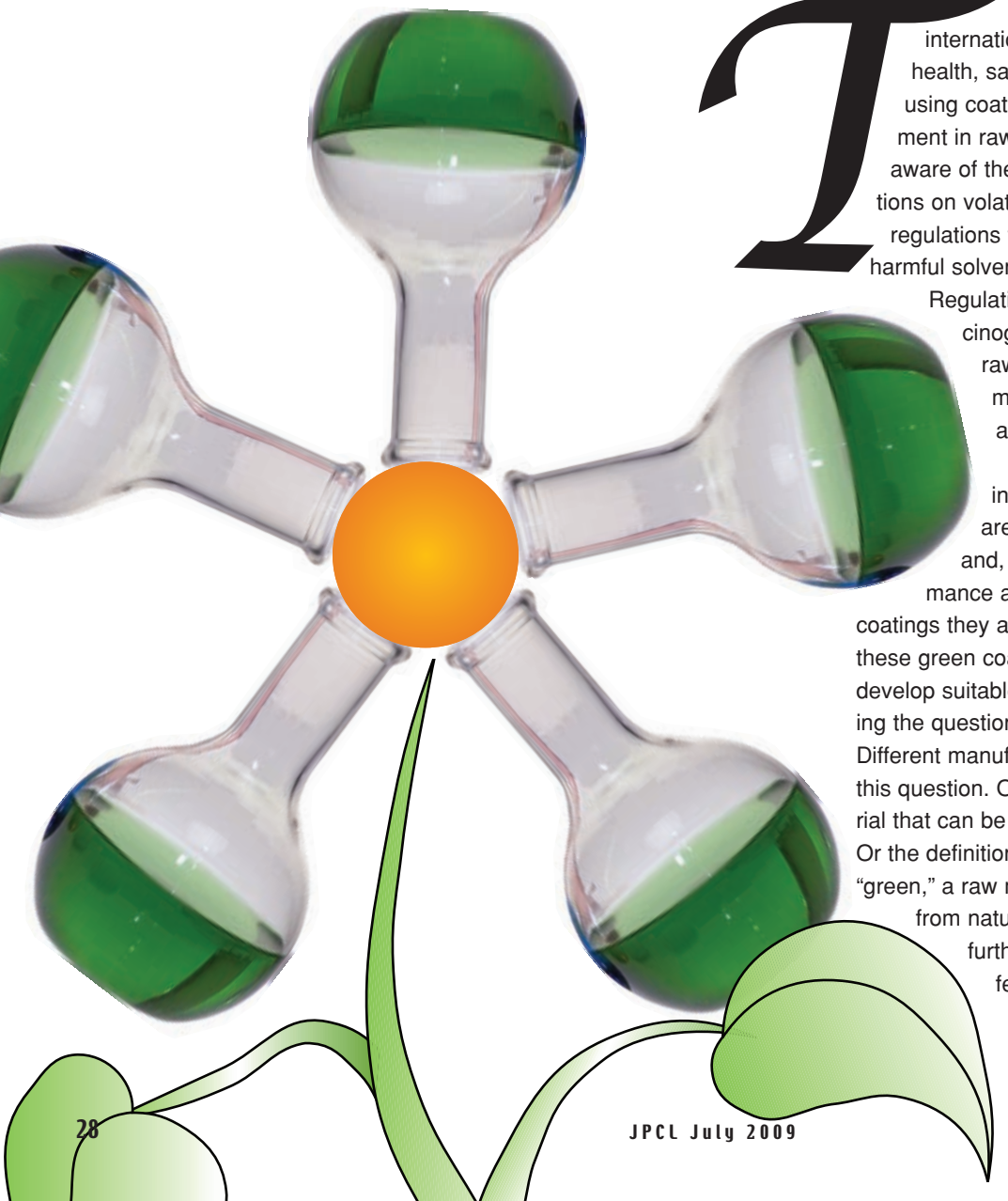
JPCL

What's New in Environmentally Friendly Coating Raw Materials

By Brian Goldie, *JPCL*



The need to meet national and international regulations concerning the health, safety, and environmental effects of using coatings governs the drive for development in raw materials for coatings. We are all aware of the increasingly restrictive regulations on volatile organic compounds (VOCs)—regulations that drive down the amount of harmful solvents released into the environment. Regulations also govern the use of carcinogenic or otherwise toxic coating raw materials, such as lead and chromates, as well as materials that affect animals and the ecosystem.

The buzz phrase is "green coatings," which refers to coatings that are environmentally and eco-friendly, and, ideally, have the same performance as the higher solvent, more toxic coatings they are intended to replace. To produce these green coatings, chemical companies must develop suitable coating raw materials, thus raising the question, "What is a green raw material?" Different manufacturers have different answers to this question. One definition could be a raw material that can be used without any harmful effects. Or the definition could be amplified so that to be "green," a raw material must also be produced from natural materials, or, taking the point further, from renewable or sustainable feed-stocks.

This article looks at a selection of new raw materials introduced to the coatings industry at the

recent European Coatings Show (Nuremberg, Germany, March 31–April 2), arguably the world's largest trade show for the coatings industry (see sidebar below). Among the approximate 800 exhibitors were companies that highlighted products designed to allow paint manufacturers to meet the demands for environmentally and eco-friendly products.

Waterborne is Trend in Green Coatings

For the high-performance protective and marine coatings market, the competing "green" technologies are waterborne systems; high(er) solids, solvent-borne systems; and powder coatings. If developments in raw materials are an indication of trends in coatings, the range of waterborne resins and additives introduced in Nuremburg suggest a bias toward waterborne coatings. Moreover, if you follow the definition of one of the major players, Bayer MaterialScience AG (Leverkusen, Germany), then waterborne systems are the answer to "What does green mean?" In fact, Bayer's motto for this year's show was "Water is green." Bayer has been marketing waterborne polyurethane dispersions for about 25 years, starting with a single trial product in 1963 and developing it into a range of more than 60 different grades. The core development concept over the years was the greatest possible substitution of solvents and co-solvents by water.

Resins

In addition to polyurethane dispersions, Bayer has concentrated on its other waterborne resin products, including hydro functional polyacrylate dispersions, polyurethane/polyacrylate hybrid dispersions, polyesters, and polybutadiene–based copolymers, for a range of applications.

Rohm & Haas (Philadelphia, PA) responded to heightened consumer desire for greener, non-polluting, better eco-designed products and focused on innovative, waterborne coatings systems that reduce VOC emissions, reduce the risk of fire, and produce less hazardous residues, while contributing advanced performance properties. The company introduced a new diffusion technology that significantly improves early property development of waterborne latex coatings in a reduced, low-VOC formulation. The new technology also maintains coalescence performance to achieve required hardness, block, and dirt pick-up resistance necessary for industrial coatings.

During the associated European Coatings Congress, Dr. Zhenwen Fu, a distinguished scientist with Rohm and Haas's Paint and Coatings Materials division, was awarded Best Paper for findings related to the company's new diffusion technology in latex paint film formulations. In latex-based coatings, he explained, VOCs are used as coalescents to ensure film formation. "Producing industrial coatings in reduced VOC latex paint formulations has been increasingly difficult to achieve while still meeting required environmental regulations," said Dr. Fu. "Designed Diffusion" technology, as advanced by Dr. Fu, is a paradigm shift in film formulation. The technology balances coatings properties through careful design of the polymer system and the selection of a coalescent package with unique partition coefficient and diffusion rate between different phases of the polymer system. His paper presents detailed analytical, physical, and application data that supports Designed Diffusion technology.

DSM (Waalwijk, The Netherlands) announced the launch of a new range of waterborne, two-component (2K) polyurethane resins that are solvent free, and allow the formulation of eco-friendly, sustainable coating solutions.

The European Coatings Show

The 2009 ECS, organised by Vincentz/ Nuremburg Messe, attracted 806 exhibitors from 42 countries. The leading exhibiting countries after Germany were China (78), Italy and UK (47 each), Netherlands (39), Switzerland (32), and Belgium (31).

Despite the worldwide economic problems of key customers, such as those in the building industry, the event proved the dynamic, innovative capability of raw material suppliers.

A total of 19,756 visitors from 100 countries attended the event. Visitor numbers declined slightly from the 2007 show, but the quality of this year's visitors compensated for the lower numbers.

Approximately 460 delegates attended the associated European Coatings Congress, where a total of 160 presentations were given in 15 themed sessions.

To produce green coatings, chemical companies must develop suitable coating raw materials, thus raising the question, 'What is a green raw material?'

Three systems designed for metallic substrates represent the company's first high-gloss, solvent-free, waterborne 2K resins. The new emulsions allow blister-free, high-build coatings. Containing no solvents, the resins offer the paint manufacturers greater freedom in formulation. The new resins allow formulators to make paints with a solvent content less than 100 g/L (previously waterborne, 2K paints had to have solvent content of 200 g/L or more). According to DSM, resulting coatings have excellent performance and appearance characteristics, comparable to those of 2K solvent-borne polyurethane systems.

Wacker Chemie AG (Munich, Germany) focused on its sustainable product solutions for coatings and presented a range of novel polymeric binders and silicone products.

Defoamers

New vegetable oil-based defoamers are now available from Evonik Industries (Evonik Tego Chemie GmbH, Essen, Germany). According to Evonik, its up-to-date alternatives to mineral oil defoamers show superior defoaming, not only in interior and exterior low-VOC coatings but also in nearly all waterborne architectural formulations.

Cognis (Monheim, Germany) also presented a range of green defoamers based on renewable raw materials. According to Cognis, these state-of-the-art performing products are an eco-friendly alternative to mineral oil defoamers for a wider range of water-based architectural paints. Containing no VOCs and only very low levels of

REACH—A Summary

REACH (Registration, Evaluation, Authorisation & restriction of Chemicals) is the EU regulation on chemicals and other substances (including metals). REACH entered into force on June 1, 2007, and will be implemented in stages up to June 1, 2018.

The aim of REACH is to have a good balance between improving protection of human health and the environment on the one hand and maintaining industry competitiveness on the other. Industry competitiveness is maintained through the rationalization of the previous EU regulatory system for chemicals. REACH replaces approximately 40 pieces of existing legislation within one regulatory framework.

The new regulation introduces a registration requirement covering all substances supplied above one ton per year and an authorization requirement covering substances of very high concern, such as carcinogens. More importantly for industry, REACH transfers the responsibility for gathering data and carrying out initial risk assessments from the government authorities to industry. According to the authorities, REACH was needed because more than 30,000 substances greater than one ton per year are on the market in the EU but with very limited information on the hazards and risks to humans and the environment. There is increasing public concern over the risks from chemicals, and the existing multiple pieces of legislation were very slow to produce results—fewer than 200 substances have been properly assessed over the past 30 years.

A new EU Chemicals Agency, based in Helsinki, Finland, will administer REACH in cooperation with the member states and competent authorities.

The key elements of REACH are summarized below.

- REGISTRATION—A manufacturer or importer will need to register any substance it supplies above one ton per year in the

semi-volatile organic compounds, Cognis's new defoamers enable manufacturers to obtain environmental quality and safety certificates such as the EU Eco-Label, the "Blue Angel," and the German TUV seal.

Wetting and Dispersing Agents

Cognis also introduced its "green" wetting and dispersing agents for waterborne coatings. Free of environmentally harmful solvents and APOEs (alkylphenolethoxylates), the new products are suitable for a wide range of applications in the architectural and industrial sectors.

Coalescents

Cognis also highlighted a natural oil-based coalescent, which, the company says, is significantly more efficient than other coalescents in lowering minimum film-forming temperature. The product is designed to allow exterior coatings to harden faster compared to other coalescents.

Additives

Eastman Chemical Company (Kingsport, TN) introduced new cellulosic additives from renewable sources to aid the formulation of VOC-compliant waterborne and solvent-borne coating systems without sacrificing performance or end-use aesthetics.

Croda Polymers & Coatings, formerly known as Uniquema (Gouda, The Netherlands), highlighted its range of bio-based raw materials. Part of the range is based on renewable resources such as vegetable oils. For example, the company's dimer fatty acids are "building blocks" for a variety of resins that offer a sustainable alternative to petroleum-derived additives.

Croda's bio-based technology has also been used to produce a range of hydrolytically stable polyester polyols that can improve storage stability and hydrolytic attack in waterborne polyurethane systems.

Anti-Corrosion Pigments

Halox (Hammond, IN) showed a sol-gel technology as an eco-friendly alternative to the traditional heavy metal alternatives.

Nubiola (Barcelona, Spain) introduced a new technology to produce a non-toxic, zinc-free anticorrosion pigment based on nano particles deposited on an inert surface for both waterborne and solvent-borne primers.

EU market. A registration dossier prepared by the supplier or importer must be provided with core hazard data, plus risk assessments for substances supplied above 10 tons per year. The registration of "existing" substances will be phased in over 10 years (2008–2018), starting with the highest tonnages by December 2010.

Companies had until December 1, 2008, to inform the EU Chemicals Agency that they would register a substance (pre-regisration).

• EVALUATION—The authorities will carry out annual in-depth evaluations (assessments) of substances flagged as posing a potentially high risk (on the basis of information provided at registration). There will be two types of evaluation: "dossier" and "substance." For the dossier evaluation, the Agency will scrutinize all testing proposals submitted (primarily to ensure no unnecessary animal testing is carried out), and 5% of all registrations will be subject to a full compliance check. In the substance evaluation, member states and the Commission agree on an annual list of substances to be assessed in depth, and competent authorities will carry out this evaluation, which may lead to new control measures or no further action.

• AUTHORISATION—Authorization must be obtained for the use of substances of very high concern, e.g., CMRs (**c**arcinogens, **m**utagens, and those toxic to **r**eproduction); PBTs (**p**ersistent, **b**ioaccumulative, and **t**oxic substances); and vPvBs (very persistent, very bioaccumulative substances). Authorization may be granted if the risks of a substance are under adequate control or a substance may be authorized on socio-economic grounds if there is no suitable safer alternative.

Companies will be required to make efforts to find safer substitutes as part of the authorization process, but any substitute must have overall lower risks and be technically and economically feasible.

Most of the REACH provisions cover manufacturers and importers of chemicals, not downstream users. However, downstream users have rights and obligations too. Downstream users have the right to request that their supplier's chemical safety assessment cover their use, and they are obliged to implement risk reduction measures that their suppliers recommend.

Heubach (Langelsheim, Germany) also had a supported non-toxic anticorrosion pigment, based on calcium.

Pigmentan (Ramat-Gan, Israel) exhibited non-toxic, heavy metal-free pigments based on magnesium. Designed for both waterborne and solvent-borne systems, the pigments, says the manufacturer, are not only eco- and environmentally-friendly alternatives, but also used renewable raw materials from the Dead Sea.

A Ripple Effect for Waterbornes

As can be seen from the above new products, emphasis was on water-based resins and additives for waterborne systems as a means of environmental compliance. However, in Europe (and spreading to other countries), we have REACH, a European Union regulation that may affect coating formulation.

REACH stands for **R**egistration, **E**valuation, **A**uthorisation, and restriction of **Ch**emicals. It came into force on June 1, 2007, and replaces a number of European Directives and Regulations with a single system. The new regulation has several aims. One aim is to protect human health and the environment against the adverse effects of chemicals. Another aim of REACH is to make the people who put chemicals on the market responsible for understanding and managing the risks associated with their use. A major part of REACH is the requirement for manufacturers or importers to register the chemicals and supply safety data on them. Some currently used chemicals may disappear because the cost of acquiring the safety data may not be economical, a problem especially relevant to waterborne coatings, which incorporate many chemicals as additives. (For further information about REACH, see the sidebar on pp. 30-31.)

Solvent-Bornes Have a Place

Despite the trend toward products for waterborne coatings, we should not dismiss solvent-borne coatings. Originally, coatings were derived from natural materials, and this practice did not change until the development of industrial chemistry and the introduction of synthetic resins. However, the demands on petrochemical resources are high and, as mentioned above, raw materials from sustainable sources need to be used. When one thinks of the common alkyd system, remember that the fatty acid components are based on natural oils, e.g., soya bean, rather than sythentic starting materials. With developments in formulation and non-harmful solvents, higher volume solids products can be obtained that meet current and future VOC limits and that are easy to apply.

With developments in formulation and non-harmful solvents, higher volume solids products can be obtained that meet current and future VOC limits and that are easy to apply.

Technical Program Reflects Trends

In addition to the exhibition, the associated European Coatings Congress was held over three days. The presentations were a strong indication of the way the industry is developing green coatings. Three sessions were held specifically on waterborne coatings, and waterbornes were featured throughout other sessions. One session addressed bio-based coatings.

Among the bio-based presentations was one from Croda on the toughening of epoxy coatings with novel bio-based polyester di-acids. According to Croda, the market is demanding solutions to reduce weight, by reducing the thickness of metal sheets but maintaining the overall protective properties of the coated metal sheet. To meet these needs, a more flexible, tough system is required, but not at the expense of other properties. Epoxy systems are commonly used because they provide hard, highly cross-linked coatings with excellent protective properties, but they tend to be brittle. The novel polyester di-acids can be grafted on the epoxy to induce phase separation, which results in flexible segments homogeneously distributed inside a rigid framework, giving a flexible and at the same time tough epoxy system.

Other products highlighted in the "Bio-based" section of the conference program included those described above from Cognis and Eastman. Nano-based coating systems and additives were also strongly represented, with three sessions devoted to these materials.

For More Information

For details about the European Coatings Show, see the sidebar at the beginning of the article and visit www.european-coatings-show.de.

Brian Goldie is based in the United Kingdom

JPCL

Corrosion under Insulation:
Basics and Resources for Understanding

By Brian Goldie and Karen Kapsanis, *JPCL*

Over the past 25 years or so, problems with corrosion under thermal insulation (CUI) have been recognized by the chemical and petrochemical industries, leading to the need for effective corrosion protection for piping, vessels, and equipment encased in thermal insulation. The first part of this article briefly reviews how the environment for CUI is created. The review also explains how piping, vessels, and equipment are typically insulated and notes the historical circumstances that contributed to CUI. The second part of the article describes two recently published consensus documents about CUI and reports on three recent studies on CUI.

The article is not intended to be a comprehensive discussion of CUI. Previous articles have addressed in varying detail many issues associated with CUI, including approaches to preventing it, performance of various coatings under insulation, and when coatings are needed under insulation (see examples, References 1–8). An upcoming article will address the issue of deciding when to coat before insulating, taking into account more than the operating conditions.

Creating the Corrosive Environment under Insulation

Corrosion of steel occurs when steel is in direct contact with water and oxygen. In most atmospheric services, corrosion occurs at such a rate that application of a protective barrier in the form of a coating system significantly extends the life of exposed piping, vessels, and equipment. The environment created when a steel surface is encased under thermal insulation is often more conducive to corrosion, resulting in significantly higher corrosion rates, than an analogous uninsulated surface.

Corrosion under insulation is of particular concern because many insulating materials trap and hold moisture against the steel so that insulated surfaces are subject to a wetted environment for greater lengths of time than uninsulated surfaces, which more readily dry out. Many surfaces are insulated to retain heat, so the time in the wetted environment is also at an elevated temperature, resulting in an increased corrosion rate. Because the progressive corrosion of insulated surfaces is not readily observed, and therefore not allowing for regular maintenance when corrosion is minor, CUI often proceeds unnoticed until consequences are severe.

The Insulation System

Insulation is typically applied to piping, vessels, and equipment in the petrochemical industry to maintain process temperatures. (In some facilities, insulation is also used to protect personnel from hot surfaces, but this topic is beyond the scope of this article.) Thermal insulation materials are generally porous materials (capable of absorbing moisture), including mineral wool, foam glass, aerogels, and polymeric foams. Insulation is clad or jacketed to prevent physical damage. Insulating and cladding materials are selected based on performance versus cost. The insulation system (insulation and cladding) must perform so that its cost at an effective thickness is more than offset by the savings resulting from maintaining process temperatures. The economics do not allow for systems with insulating materials that are highly impermeable to moisture ingress and with cladding that is moisture tight. Additionally, damage to the external cladding on the insulation can be caused at installation, over time as personnel walk on the insulation or drop

heavy objects, or through deterioration with time. Therefore, most thermal insulation systems are subject to moisture ingress, and CUI is a possibility.

Common external sources of moisture are humidity, fog, rain, testing of fire safety deluge systems, and washing down of equipment and facilities. Salt and chemical contamination from industrial pollution and coastal proximity can also be present in the water, further increasing its corrosivity to carbon and stainless steels.

A Historical Note on CUI

Up until the 1970s, CUI was not generally a problem. Economics at that time were such that piping, vessels, and equipment were not insulated unless the operating temperature was above 150 C (302 F). Insulated steel surfaces that were 150 C or higher much of the time remained dry, so significant amounts of corrosion did not occur.

The oil shortage of the 1970s changed industrial insulation practices. Escalating energy prices changed the economics such that efforts to retain heat in processes operating below 150 C were now beneficial. At these lower temperatures, insulated surfaces were wetted more often and subject to corrosion. Coating systems that had been used successfully on uninsulated surfaces were subsequently used under insulation. These systems performed poorly in the hot, wetted environment created under thermal insulation below 150 C; problems with CUI started to emerge; and their significance increased.

The fact that a hot aqueous environment was present under the insulation (due to water penetration, as described above) was not originally appreciated. The conventional atmospheric coating systems of the day could not protect adequately against corrosion in what are essentially immersion conditions. Corrosion under insulation continued unobserved until the steel was so seriously damaged that it became evident by leaks or structural failure.

These problems led to the use of immersion-grade coating systems capable of providing effective corrosion protection in a hot, wetted environment and resisting maximum operating temperatures up to approximately 220 C (425 F). Mitigating CUI became the subject of a NACE International guideline, published over a decade ago and updated in 2004 (Recommended Practice RP0198, "The Control of Corrosion Under Thermal Insulation and Fireproofing Materials - A Systems Approach").

The Problem Persists

Despite advances in understanding the corrosive nature of the environment associated with an insulated structure and the kinds of coatings that can withstand the exposure, the problem persists, as evidenced by the issuance in 2007 of an ASTM guide to laboratory tests for CUI; by the publication of a 176-page guidance document on CUI from the European Federation of Corrosion (EFC); and by some of the types of research into protection against CUI.

ASTM Issues CUI Lab Testing Guide

From ASTM Subcommittee G01.11 on Electrochemical Measurements in Corrosion Testing came the 2007 consensus document, ASTM G189, "Standard Guide for Laboratory Simulation of Corrosion under Insulation." As noted in the Scope, the Guide addresses laboratory simulation of general and localized CUI. It calls for test specimens to be insulated sections cut from pipe and exposed to a corrosive environment that includes elevated temperature. Described in the standard are a testing apparatus for CUI exposure, specimen preparation, procedures for simulating temperatures, as well as wet and dry conditions of a CUI environment. While the guide is intended mainly to help establish acceptable approaches to simulating CUI on carbon steel or low alloy steel for pipe, the Scope states that the test procedures might be useful for assessing other metals, anti-corrosion materials on pipeline, and other aspects of CUI, as long as the samples are suitable for the test apparatus.

EFC Guideline

The EFC Working Parties WP13 and WP15 issued Corrosion under Insulation (CUI) Guidelines: (EFC 55) in March 2008. Edited by Stefan Winnik of ExxonMobil Chemical and published by Woodhead Publishing, the volume represents the work not only of the working parties but also of major European oil refining, petrochemical, and offshore companies that collaborated with WP13 and WP15.

The volume covers everything from economics to materials, practices, inspection, testing, and more. Among the chapters are the following.

- "Economic consideration"
- "Ownership and responsibility"
- "The risk-based inspection (RBI) methodology for CUI"
- "Inspection activities/strategy"
- "NDE/NDT screening techniques for CUI"
- "Recommended best practice to mitigate CUI"

A wealth of appendices to the document amplify topics such as cost analysis, quality assurance, types of insulation, suitable coatings, including thermal spray, application methods, cladding, protection guards, and inspection techniques.

Continued

Industry Research

Several industry research studies from petrochemical, pipeline, and other interested companies were presented at NACE International's Corrosion 2008 Conference and Expo (New Orleans, LA).

Researchers from ExxonMobil and Honeywell Process Solutions conducted a laboratory investigation of CUI on steel in three conditions: uncoated, coated with thermal sprayed aluminium (TSA), and coated with TSA but with defects that exposed the steel. Two types of insulation were also tested over the coated and uncoated steel: mineral wool and calcium silicates. Researchers followed ASTM G189 to approximate field conditions of cycling temperatures and alternating wet and dry conditions. Of the three types of steel samples, specimens protected with TSA (with no coating defects) showed the lowest corrosion rates under each type of insulation tested. The test methods, specimens, procedures, and results are detailed in "Evaluation of Steel and TSA Coating in a Corrosion under Insulation (CUI) Environment," by Russell D. Kane, Monica Chauviere, and Keith Chustz, and published in the NACE Corrosion 2008 proceedings (Paper No. 08036).

A study conducted by Shaw Pipe Protection Limited looked at an epoxy coating for its suitability for use under insulating foam with resistance to high heat, at or above 150 C. The structure studied was buried pipeline. The high service temperature is needed for moving bitumen extracted via thermal recovery from the oil sands in Alberta, Canada. M. Batallas and P. Singh reported on the methods they used to test the epoxy and their results in "Evaluation of Anticorrosion Coatings for High-Temperature Service," Paper No. 08039 NACE Corrosion 2008 proceedings.

Because CUI can be hidden for a long time beneath cladding and insulation, it often is not recognized until damage to a pipe or vessel is dramatic. Systematic inspection of insulated equipment is an approach to reducing damage from CUI by catching it sooner, before the damage is dramatic, extensive, and expensive. Two approaches to inspecting equipment and structures for CUI were the subject of a study that two ConocoPhillips refineries undertook. One approach involved direct initial and then thorough inspection and maintenance as needed of insulated equipment. The initial inspection helped isolate equipment that needed refurbishment. The second approach omitted a direct initial inspection and instead used a software pro-

gram to identify insulated equipment for inspection and maintenance as needed to prevent or mitigate CUI. Authors Rob Scanlan, Ricardo Valbuena, Ian Harrison, and Rafael Rengifo report on the differences in the effectiveness of the methods in identifying and remedying or preventing CUI ("A Refinery Approach to Address Corrosion under Insulation and External Corrosion," NACE Corrosion 2008 Paper No. 08558.

Futher Information

For information about ASTM G189, visit www.astm.org. For information about the EFC Guide, visit www.efcweb.org. For information about the NACE RP0198 and the three NACE papers and discussed above, visit www.nace.org.

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Brian Goldie, JPCL*'s Technical Editor, worked in the oil industry for many years. Karen Kapsanis is the Editor of* JPCL.

JPCL

L. Skip Vernon Is First SSPC Master Coatings Inspector

Skip Vernon has become the first coatings professional to achieve SSPC Master Coatings Inspector status. The Master Coatings Inspector (MCI) program recognizes and honors professional inspectors whose experience and training has enabled them to earn multiple inspector certifications.

In addition to his MCI status, Mr. Vernon is a certified SSPC Protective Coatings Specialist and an SSPC instructor; he is also certified by ASPE (American Society of Professional Estimators), CSI (Construction Specifications Institute), NACE, and PDRA (Paint & Decorating Retailers Association).

To reach the MCI level, one must qualify for certification as a Concrete Coating Inspector (CCI) as well as qualify for two of the three other SSPC inspector programs: Bridge Coatings Inspector (BCI), Protective Coatings Inspector (PCI), and the NAVSEA Basic Paint Inspector course (NBPI), which SSPC administers on behalf of Naval Sea Systems Command. Mr. Vernon is qualified as a CCI, BCI, and PCI.

Mr. Vernon's background includes over 25 years of industrial coating application experience, although his current role is as a consultant and legal advisor on coatings-related technical and legal issues. He is currently the president and owner of Coating & Lining Technologies, Inc., for whom he has worked since 1984. His duties involve coatings litigation support and analysis, including expert services (testifying and consulting); claim analysis and preparation; specification review and writing; estimating; and damage cost analysis. In the past, he has worked for companies such as The Gateway Co., Inc., Heritage Painting Co., Inc., and Monticello Painting Co.

Mr. Vernon is also an instructor for the following SSPC training programs: Protective Coating Inspector Training and Certification Program (PCI); Fundamentals of Protective Coatings (C-1); Managing Coatings Projects (C-2); and the Concrete Coating Inspector Program (CCI).

His formal education includes a Bachelor of Individualized Studies with a major emphasis in chemistry from New Mexico State University in 1979 and a Juris Doctor degree from the University of New Mexico School of Law in 1992.

Mr. Vernon is also a retired New Mexico State Senator, having served in that body from 1984 to 2000, including as Senate Minority Leader from 1998-2000.

When asked why he applied for the MCI certificate, Mr. Vernon cited several reasons. "This certificate is special—it recognizes the significant commitment to study and the investment of time and resources necessary to attend the classes and obtain the certifications to qualify for the credential. Also, having grown up in the painting business working for my father, it was my impression that many people in the other construction trades often looked down on the 'painters.' However, after many years, I learned the painting profession is as complex and demanding as any of the other trades."

Mr. Vernon thinks the MCI status will benefit him in his work. "In my work, I rely on people hiring me to perform a critical and expensive function on their behalf. The coating failure analysis and coating claim work that I perform typically involves fairly high dollar claims—and the stress associated with that for my clients. The [MCI] training increases my knowledge and thereby my ability to assist my clients—I am engaged to find the answer, not just an answer. Furthermore, credentials such as this, and training such as that offered by SSPC, serve to help people assess and differentiate between people offering the same services."

He believes all SSPC training programs offer benefits, and names several. "First and most obvious is the knowledge gained from the classes that can be utilized to help others in the field," he says. He likes the networking opportunities provided by training courses, particularly those held at conferences. He also sees value in the credential itself: "When someone sees that you have taken the time to attend the training and acquire the knowledge and credentials, they can make some basic assumptions about your knowledge or skill level. Finally, as a testifying expert, one must realize that a jury often makes judgments about an expert's 'expertise' based on their credentials."

What kind of approach to career advancement would Mr. Vernon recommend for people just starting out in the coatings industry? "I believe a person can acquire knowledge working in the field while also working to acquire the additional knowledge available through the training and certification programs. It's not easy to study after blasting all day, but it pays off in the end. I believe one should try to become as valuable as possible to their boss or client—the intentional accumulation of knowledge makes that possible."

Mr. Vernon sees benefits from the MCI program for professionals involved in all facets of industrial painting. "It is beyond challenge that anyone who wants to increase their value in the painting business can benefit from making a concerted effort to acquire more knowledge through training and certification."

For more information on how to become a Master Coatings Inspector, please contact Terry Sowers—tel: 877-281-7772, ext 2219; email: sowers@sspc.org.

Continued

Training Roundup

Since 1990, SSPC training programs have provided over 35,000 coatings professionals with the opportunity to maintain and expand their knowledge of coatings technology, standards, and practices. The following is a brief recap of some of the courses held around the globe in February and May.

Students of the May Plural Component class in Bessemer, AL, at Vulcan Painters, Inc.

Fifteen students attended the first ever SSPC "PCI night school" course in Singapore, February 2–13, 2009. SSPC decided to offer the evening version at the request of Alexander Wijaya and Abdul Rashid, this year's SSPC Education Award winners. They told SSPC that many people wished to attend the course, but could not leave work to do so.

Students of SSPC's first ever PCI night school in Singapore. Bani Quim and Muniandi Dewadas taught the course for 12 evenings, including the exam.

Working closely with our instructors, SSPC developed a schedule where class is held every evening for 11 days, followed by the certification exam on the 12th evening. According to SSPC Instructor Bani Quim, students would put in a full day at work and then attend the PCI course in the evenings. Quim, who taught this class with Muniandi Dewadas, said that it is a very long day for the students, but they were all determined to take the course and achieve certification.

A second successful evening course was held in Batam, Indonesia, beginning February 20, and was taught by Alexander Wijaya and Bani Quim.

Students of the first Water Jetting Program (C13) in Canada, hosted by Certified Coating Specialists Inc.

SSPC held its first Water Jetting Program (C13) in Canada on May 23–24. The class was hosted by Certified Coating Specialists Inc. (SSPC-QP 1- and QP 2-certified) in Castlegar, BC, Canada. There were 12 Students in attendance and the instructor was Earl Bowry.

A SSPC Plural Component class was held May 12–13 at Vulcan Painters, Inc. in Bessemer, AL. Frank Saunders, Sherwin-Williams Protective and Marine Coatings technician, taught the class of 15 students.

After a day of lecture and quizzes, participants went one-on-one with their instructor to demonstrate their competence with machinery, set-up, and operation. "It changed my attitude toward the pumps," said Tommy Collier of Vulcan about the class. "You get more material on places you didn't get it before." And a balky pump during the exam forced him to practice the troubleshooting he had read about in the course instruction material. "It definitely gave you insight into what to do when things go wrong and how to correct it, which with anything new you're going to have to go through—what the problems could be and possible solutions."

Madison Smith of Vulcan had used a plural component pump before but not the model used for the class. "I did get a lot of information I didn't know, and it helped out tremendously...What we learned in class we actually had to take outside and put hands-on at the pump."

"Frank Sanders is really good in this class, he really knows his equipment," said Les Wain of Vulcan.

Attending the class were Lonnie Scholl, Richard Kemmis, and Chad Johnson, all of Maguire Iron Inc., Sioux Falls, SD; Richard Partain, FTI of District Council 77 in Atlanta, GA; and Duane Carter, Bill Collier, Vincent Grant, Andre Collier, John Jenkins, Jason Mahannah, Madison Smith, Les Wain, Frank Watson, Tommy Collier, and Andre McMillan of Vulcan Painters.

SSPC Issues New Coating Standard, Revises PA Guide 5

SSPC has issued a new paint system standard, "PS 28.01, Two-Coat Zinc-Rich Polyurethane Primer/Aliphatic Polyurea Topcoat System, Performance-Based." The standard contains performance requirements for a coating system for steel substrates that consists of a corrosion-resistant zinc-rich moisture-cure polyurethane primer (complying with SSPC-Paint 40) and an aliphatic polyurea

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topcoat with high color and gloss retention (complying with SSPC-Paint 39, Type 2).

The coating system is generally suitable for exposures in SSPC Environmental Zones 1A (interior, normally dry), 1B (exterior, normally dry), 2A (frequently wet by fresh water, excluding immersion), 2B (frequently wet by salt water, excluding immersion), 3B (chemical exposure, neutral) and 3C (chemical exposure, alkaline).

SSPC PS 28.01 is intended for specifiers, coating manufacturers, and end users who desire a coating system that combines performance requirements of a polyurethane primer containing zinc pigment for corrosion resistance and an aliphatic polyurea topcoat with good gloss and color retention.

SSPC has also made editorial changes to "SSPC-PA Guide 5, Guide to Maintenance Coating of Steel Structures in Atmospheric Service," updating references to standards and course materials.

The revised PA Guide 5 and SSPC PS 28.01 are available through the SSPC MarketPlace, where members have free access to all SSPC standards, guides, and specifications. Both new documents are also provided as supplements to the latest edition of *Systems and Specifications, SSPC Painting Manual, Volume 2*.

For more information, contact SSPC—tel: 877-281-7772 or 412-281-2331; email: books@sspc.org.

SSPC Honors Student

Ameer A. Fields receiving the SSPC Award for excellence in structural coatings technology.

SSPC honored Mr. Ameer A. Fields for Excellence in Structural Coatings Technology at the May 29th graduation ceremonies at the Williamson Free School of Mechanical Trades.

Each year, SSPC recognizes a student who has excelled in the area of Coatings Technology with a $50 check, a certificate, and a two-year membership to SSPC.

SSPC congratulates Mr. Fields and all of the graduates of the class of 2009.

Secondary Surface Prep after UHPWJ: Saving Coatings or Just Increasing Cost?

Many shipyards are using ultra-high-pressure water jetting (UHPWJ) to prepare steel surfaces, raising concerns about the possible impact of flash rusting on coating life, according to a paper by J. Peter Ault, P.E. (Elzly Technology Corporation) and Steve Cogswell (Atlantic Marine and Drydock, SSPC-QP 1-certified). "Performance of Marine Coatings Applied over Flash Rusted Surfaces" was presented at PACE 2009, held February 15-18, 2009, in New Orleans. The National Shipbuilding Research Program (NSRP) and the U.S. Navy Southeast Regional Maintenance Center (SERMC) sponsored the study.

The authors researched the impact of UHPWJ-related flash rusting on U.S. Navy ship hulls. They compared the performance of coatings on four hulls prepared by two different methods—closed-loop water jetting on broad areas and hand-lance water jetting supplemented by secondary surface preparation on more complex areas. Of note: hand lances, because they do not incorporate water removal devices, tend to wet surfaces for a longer period of time than closed-loop systems.

SSPC-SP 12/NACE No. 5, Surface Preparation and Cleaning of Metals by Waterjetting, defines the four levels of flash rust as "No Flash Rust," "Light," "Moderate," and "Heavy." According to the authors, some commercial ship owners allow coatings to be applied over "moderate" levels of flash rust, but the U.S. Navy only allows painting over areas with "light" levels. The Navy requirements usually mean using a second method of surface preparation on hand-lanced areas, which can increase the cost by up to 20% on an underwater hull, the authors say. The purpose of their study was to determine if areas with "moderate" flash rust need secondary surface preparation for the coat-

Continued

ings to perform as well as coatings on areas with "light" flash rust.

Determining the Test Methods

The authors identified four ships on which hull preservation work was performed around 2001-2002 and which were dry-docked in 2007. During each of the dockings, the authors collected information to determine whether there were any differences in coating performance between areas that had been close-loop cleaned or hand lance cleaned.

An inspection team for the study consisted of a consulting engineer who performed the testing, a Navy representative who participated in the inspections when the surface preparation and coating work was originally done, and shipyard personnel who were also present for the original work. According to the authors, the team first performed visual inspections. After the ship was hauled and cleaned with low-pressure water, observations were made from the dry-dock floor, and areas that could have been cleaned with close-looped UHPWJ were inspected for coatings failure. The visual inspections did not reveal a difference in coatings performance between the two UHPWJ methods.

Physical evaluations were then developed, including selectively removing the topcoat to expose the primer, performing tests to determine the integrity of the coating (pull-off adhesion, coating capacitance, film thickness), and removing a small area of the epoxy for visual examination of the steel and the primer-to-steel bond.

The Results Are In

The team found that two of the ships had no visual differences between areas hand cleaned or machine cleaned, the underwater hull was in good shape with negligible blistering, and the paint appeared intact and well-adhered. The freeboard coating had some localized rusting on locations of mechanical damage and near overboard discharges. The authors stated that, on one of these two ships, the rud-

ders had 100% failure of antifouling, and the top layer of ablative antifouling coating was lost as marine growth dried. However, the ablative antifouling coating on the hull remained intact.

Two of the ships were inspected. On one ship, eight areas were chosen: six on the underwater hull (four were cleaned with hand-lance and two likely with closed-loop) and two on the freeboard (one was cleaned with hand-lance and one likely with closed-loop). The coating showed 2% blistering on the underwater hull, and several blisters were popped and contained a liquid with a pH of 12-13. The anticorrosive coating was a red primer and a gray intermediate, and nearly all of the adhesion tests failed within the primer or at the adhesive, according to the authors.

On the other inspected ship, eight areas on the underwater hull were inspected: four that were cleaned by hand lance and four that were likely cleaned with closed-loop UHP. No significant coatings problems were observed, and there was minor blistering along the keel and below the overboard discharges. A two-coat system of red primer and gray intermediate failed the adhesion tests within the primer and between the primer and the substrate. For both of the inspected ships, no evidence of coating failure related to hand-lance cleaning was revealed.

Overall, according to the authors, none of the tests showed a difference in the performance of coatings after five or six years that can be attributed to the different surface preparation techniques. They conclude that secondary surface preparation to remove moderate flash rust is probably unnecessary after hand-lance waterjetting, and eliminating this step would save money.

To obtain a copy of this paper in its entirety, contact SSPC at 877-281-7772.

Researchers Study Preparation Options for Repair Materials in Wastewater Plants

Before a protective coating is applied to a cementitious repair mortar used to rehabilitate deteriorated wastewater concrete infrastructure, is it better to broom finish the repair material, or to abrasive blast it? This is the issue that authors Vaughn O'Dea and Rick Schwab of Tnemec Company investigate in their paper, "Caveat Emptor! Preparing Cementitious Mortars To Support High-Performance Lining

Continued

ders had 100% failure of antifouling, and the top layer of ablative antifouling coating was lost as marine growth dried. However, the ablative antifouling coating on the hull remained intact.

Two of the ships were inspected. On one ship, eight areas were chosen: six on the underwater hull (four were cleaned with hand-lance and two likely with closed-loop) and two on the freeboard (one was cleaned with hand-lance and one likely with closed-loop). The coating showed 2% blistering on the underwater hull, and several blisters were popped and contained a liquid with a pH of 12-13. The anticorrosive coating was a red primer and a gray intermediate, and nearly all of the adhesion tests failed within the primer or at the adhesive, according to the authors.

On the other inspected ship, eight areas on the underwater hull were inspected: four that were cleaned by hand lance and four that were likely cleaned with closed-loop UHP. No significant coatings problems were observed, and there was minor blistering along the keel and below the overboard discharges. A two-coat system of red primer and gray intermediate failed the adhesion tests within the primer and between the primer and the substrate. For both of the inspected ships, no evidence of coating failure related to hand-lance cleaning was revealed.

Overall, according to the authors, none of the tests showed a difference in the performance of coatings after five or six years that can be attributed to the different surface preparation techniques. They conclude that secondary surface preparation to remove moderate flash rust is probably unnecessary after hand-lance waterjetting, and eliminating this step would save money.

To obtain a copy of this paper in its entirety, contact SSPC at 877-281-7772.

Researchers Study Preparation Options for Repair Materials in Wastewater Plants

Before a protective coating is applied to a cementitious repair mortar used to rehabilitate deteriorated wastewater concrete infrastructure, is it better to broom finish the repair material, or to abrasive blast it? This is the issue that authors Vaughn O'Dea and Rick Schwab of Tnemec Company investigate in their paper, "Caveat Emptor! Preparing Cementitious Mortars To Support High-Performance Lining

Continued

Systems: Broom Finish or Blasted Surface," given at PACE 2009, held February 15–18 in New Orleans, LA.

The authors note that while concrete is an excellent material of construction used extensively in municipal wastewater facilities, the substrate is, nonetheless, subject to deterioration when exposed to service environments found in wastewater applications. Conditions in that environment include abrasion, corrosion of steel reinforcement, and biogenic sulfide corrosion. As a result, cementitious mortars are used to repair the concrete, and high-performance coatings are applied to protect both the repair materials and the concrete. According to the authors, the use of these repair materials and coatings is increasing, but this increase has led to conflicting instructions on how to best cure, finish, and prepare the repair mortars before applying a protective coating.

One of the chief factors in the effectiveness of the rehabilitation and protection of wastewater concrete is the adhesion of the repair materials and the coating to the parent concrete. According to the authors, the repair mortar and coating must have adhesive strengths greater than the tensile strength of the parent concrete. Therefore, the authors' investigation focused on determining which surface finish optimizes adhesion of a high-performance lining system to a repair mortar.

One of the main hindrances of coating adhesion to repair mortars is the formation of a layer of laitance on the repair material surface. The authors wondered, "Is it possible that a broom finished surface eliminates the formation of a laitance layer on cementitious repair mortars and provides equal or greater tensile strength than that of the properly prepared parent concrete?"

After surveying 100 wastewater projects, the authors identified the four most commonly used generic types of cementitious mortars for wastewater applications: epoxy modified, acrylic modified, Portland based, and calcium aluminum based. For the study, three commercially available repair materials from each generic type were obtained for use. The adhesion properties of the 12 mortars were compared when they were applied at their respective minimum recommended thicknesses.

The repair materials were applied to concrete substrate panels that consisted of a high-strength 5,500 psi Portland Type I design mix conforming to ASTM C387.

As a representative protective lining used over cementitious mortars in aggressive environments, the authors selected for the study a high-build, 100% solids, two-component high-functionality amine epoxy. The coating was applied at a dry film thickness of 30 mils (750 microns).

The bond strength of the repair materials was tested per ASTM D7234. The author found that eight of the twelve repair mortars, when broom finished, yielded significantly lower adhesion values than that of the abrasive-blasted surfaces. Adhesion values for broom-finished and abrasive-blasted surfaces were comparable only with the epoxy cementitious composites. Also, except for the epoxy cementitious composites, the authors concluded that a broom-finished surface forms a layer of laitance on the surface of the repair materials.

An article based on O'Dea and Schwab's PACE 2009 paper will be published in an upcoming issue of *JPCL*.

To report on research about industrial and marine coatings technology and work, contact Karen Kapsanis, Editor, *JPCL*, at kkapsanis@protectivecoatings.com.

associations

Thermal Spray Society Honors 3

The ASM Thermal Spray Society (TSS) named three inductees to the 2009 Hall of Fame at the International Thermal Spray Conference in Las Vegas in May. The Hall of Fame was established in 1993 to recognize and honor outstanding leaders who have made significant contributions to thermal spraying.

• Daryl E. Crawmer, director of technology for Thermal Spray Technologies in Sun Prairie, WI. According to TSS, he was inducted "for advancing thermal spray technology through numerous inventions in equipment and process design, and for being an invaluable source of information and advice to the thermal spray community." Crawmer has been working with thermal spray for 37 years and is a long-time member and former vice chair of the *Journal of Thermal Spray Technology* Committee.

• Akira Nakahira, chairman and CEO of TOCALO Co., Ltd. (Kobe, Japan), and president of the Japan Thermal Sprayers Association. TSS states that he was inducted "for the development and industrialization of innovative thermal spray coatings, [for] fostering one of the world's largest thermal spray job shop companies, and for the advancement of thermal spray as a fundamental technology." Nakahira's career in thermal spraying spans 51 years and includes being the vice chair for two worldwide thermal spray events, ITSC '95 in Kobe and ITSC 2004 in Osaka.

• Anatolii N. Papyrin, president of Cold Spray Technology LLC in Albuquerque, NM. TSS inducted him "for outstanding scientific and technological contributions to the research and development as well as the commercialization of the cold spray process." Papyrin has been developing and improving cold spray since 1994 at the National Center for Manufacturing Science in Ann Arbor, MI; Pennsylvania State University; and Ktech Corporation in Albuquerque, NM.

NACE Announces New Board Members

NACE International (Houston, TX) announced its new board of directors, which consists of 12 directors and 4 officers. This year, there are 3 new directors and 3 new officers.

Mark J. Byerley, Sr. will serve as NACE president. He is the president of Tinker & Rasor. The NACE vice-president is Chris M. Fowler, Ph.D., global director of corrosion for Bodycote Testing Group. Starting a new two-year term as treasurer is Paige A. Herbert. She is the NACE Eastern Area's permanent treasurer.

The new directors are Graham Bell for the Western Area, A.I. (Sandy) Williamson for the Northern Area, and Michael Baach for Member Activities.

Visit www.nace.org for more information.

companies

Dow Forms New Coatings Business

The Dow Chemical Company (Midland, MI) has announced that its newly formed business unit, Dow Coating Materials, will be the world's largest supplier of coatings raw materials and technologies. Establishment of the new unit follows Dow's acquisition

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Farr APC Adds Thermal Spray Post

Farr Air Pollution Control (APC), in Jonesboro, AR, appointed Scott R. Goodspeed to the new position of thermal spray market manager. He will oversee all aspects of the thermal spray dust collection business.

Goodspeed has 36 years of sales, managerial, and technical experience in the thermal spray industry. He is a member of the International Thermal Spray Association, having served as the past chairman, vice chairman, and association chairman; the American Society of Metals; the Thermal Spray Society; and the American Welding Society, where he served on the Committee for Thermal Spraying (C2).

Farr APC manufactures a full line of dust and fume collectors and filters for all types of thermal and flame spray processes.

Scott Goodspeed

of Rohm & Haas in April 2009. The new business will combine the resources and technologies of Dow Coating Solutions with Rohm & Haas' paint and coating materials to supply raw materials for architectural and industrial coatings.

Dow Coating Materials will provide several different product lines, including latex emulsions (acrylics, vinyl acrylics, styrene acrylics), epoxies, solution vinyl resins, and other polymer technologies. The business will offer rheology modifiers and cellulosic-based products. The new company also plans to enhance other product lines within Dow, such as biocides, acrylic monomers, surfactants, and polyurethanes.

PPG Combines Resources with Dynasystems

PPG Industries (Pittsburgh, PA) has signed a mutual supply and marketing collaboration agreement with Dynasystems (Hampshire, UK), a global supplier of blast and ballistic protective systems, to combine resources in developing and distributing a portfolio of products for physical asset protection.

By combining resources, the companies will be able to offer a complete solutions strategy based on anticipated threat levels. The combination of PPG's Mil-Tough Blast Resistant Polyurea Coating and Dynasystem's DynaBlok protective wall system is designed to increase survivability on new buildings, floors, walls, and other assets.

Dynasystems is a supplier of blast and ballistic protective systems for walls, doors, windows, polymers, and films to several sectors.

PPG is a global supplier of paints, coatings, specialty materials, chemicals, fiber glass and glass, and optical products.

Cognis Helps Build Hybrid Car for Marathon

A student project team at the Royal Institute of Technology (KTH) in Stockholm, Sweden, built an eco-friendly race car incorporating the one-component resin system Tribest from Cognis (Monheim, Germany). The car was a bio-based urban hybrid concept car that entered the Shell Eco-marathon in May at the EuroSpeedway Lausitz racetrack in Germany.

The student project team built the car body out of Tribest and hemp fibers. Tribest is a patented resin used to make matrices for composite materials. The company says it is based on renewable raw materials (acrylate functional resin system derived from soya oil).

The Shell Eco-marathon focuses on finding innovative solutions for building sustainable cars and provides a global forum for students to help find solutions to the world's energy challenges.

Study Released on Asian Biocides

Kusumgar, Nerfli & Growney, a consulting firm in Lodi, NJ, has released its most recent study, Asian Coating Biocides, 2008-2013. According to the report, 2008 coating biocide consumption in Asia was approximately 30 million lbs, worth $174 million, and is expected to grow 9% a year through 2013. Over 90% of the biocides are used in waterborne architectural paints; however, growth in architectural paints will be down in 2009 due to the economy, the study states.

Marine fungicide consumption in Asia (with the exception of cuprous oxide) in 2008 was over 7 million lbs, worth $77 million, and has a forecasted 8% annual rate of growth. The study predicts that shipbuilding and repair activity will remain strong over the next several years, but marine biocide growth will slow in the latter part of the five-year forecast.

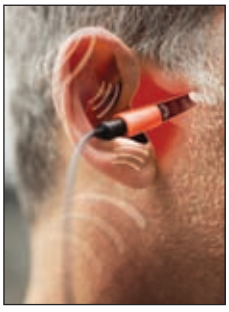
China is the largest consumer of biocides in Asia, with Japan and South Korea coming in second. India is considered the fastest growing consumer in the region, according to the study.

To subscribe to the report, contact the company at nerlfikng@cs.com.

products

In-Ear Noise Monitoring from Howard Leight

Howard Leight (Smithfield, RI) has introduced a personal dosimeter that measures and records a worker's in-ear exposure to noise over an entire work shift. The QuietDose allows workers to monitor and control noise exposure. According to the company, flashing lights indicate when noise exposure reaches prescribed limits and allows managers to monitor exposure during each shift or work week.



The product consists of a small Exposure Smart Protector® (ESP) Dosimeter that is worn in a shirt pocket or on the back of a hardhat, protective eartips with integrated microphones, and a connecting harness.

For more information, visit www.howardleight.com.

Blastrac Introduces Hand-Held Grinder

Blastrac, NC (Oklahoma City, OK) has introduced its new angle grinder, the

BL-233. The hand-held grinder has won UL approval and is manufactured specifically for concrete prep and coatings removal, according to the company.

The grinder is 19 in. long and weighs 9 lbs before attaching the shroud or grinding wheel. The motor is 120V, 15 amps, and runs at 6,600 rpm. There is a safety switch to guard against unintentional starts, and the grinder will accept a 7 in. diameter disk on the 5/8-11 threaded spindle, the company says.

For more information, visit www.blastrac.com.

EMSEAL Expansion Joint is Fire-Rated

EMSEAL has introduced a new fire-rated expansion joint, the Emshield DFR2. According to the company, the product is the market's first UL-certified, single-unit, fire-rated expansion joint that withstands traffic, is watertight, and accommodates high-movement.

DFR2 stands for "deck, fire-rated two hours." It provides a fire stop at the sealed joint when that joint is part of a four-inch deep or larger concrete group and runs horizontally, which the company says is common. The product is made of fire-retardant-impregnated foam that is pre-coated with a fire-proofing material on the underside and a highway-grade, fuel-resistant silicone on the traffic side. The joint is installed into a joint gap that has been primed with field-applied epoxy and finished with field-injected silicone sealant bands against the substrates.

EMSEAL (Westborough, MA) manufactures premium sealants, expansion joints, and gasket products. Visit www.emseal.com for more information.

New MSA Safety Harnesses Improve Comfort

MSA, located in Pittsburgh, PA, is offering two new safety harnesses—the Custom Gravity Harness with Adjustable Y Back D-Locator Pad and the Custom TechnaCurv™ Harness.

Custom Gravity is available in vest and cross-over styles. The company says that the pad provides a better fit, easy adjustment, and increased comfort. The harness is designed for controlled descent, positioning, ladder climbing, rescue, and fall arrest.

The Custom Techna-Curv™ has a patented curvilinear comfort system with a curved neck and torso webbing with an adjustable Y Back D-Locator pad. According to the company, the harness has visco-elastic shoulder padding that adjusts to the body and Sorbtek fabric to keep moisture away from the body.

More information can be found at www.msanorthamerica.com.

Bullard Designs Lightweight Respirator

Bullard (Cynthiana, KY) now offers EVA (Evolutionary Air), a powered, lightweight air-purifying respirator. The company designed the new product based on input received from users and experts in the field.

Features include two alarms to notify wearers of low battery and low air flow; a 10,000-hour brushless motor; a two-speed blower to control cooling and air flow; and a contoured belt for extra comfort. The product is NIOSH approved, according to the company.

Visit www.bullard.com for details.

Odyssey Contracting Wins Suspension Bridge Painting Project

Photo courtesy of Library of Congress Historic American Engineering Record

Odyssey Contracting Corp. (Houston, PA) was awarded a contract of $9,348,250 by the Maine Department of Transportation to recoat the Deer Isle-Sedgwick Bridge, a suspension bridge over Eggemoggin Reach that was built in 1939 and features a 1,088-foot-long main span. The contract, which required SSPC-QP 1 and QP 2 certification, also includes performing various repairs.

The project includes applying an organic zinc-phenalkamine epoxy-urethane system to abrasive blast-cleaned structural steel, a phenalkamine epoxy-urethane system to power-tool-cleaned fairings, and a 3-coat waterborne elastomeric acrylic system to hand-tool cleaned main cables and wire ropes. The surface preparation includes lead-based paint abatement, with containment and hazardous waste disposal according to SSPC-Guide 6 and Guide 7, respectively.

Florida DOT Awards Bridge Bearing Repair Bid

The Florida Department of Transportation awarded a contract to Intron Technologies (Jacksonville, FL) to perform repairs and coatings application to steel bearings on the Northbound Howard Frankland Bridge, a 15,872-foot-long by 58-foot-wide bridge over Old Tampa Bay. The contract is valued at $1,705,285.

Corps of Engineers Awards Stop Log Repair Contract

Extreme Coatings, Inc. (Pasco, WA) won a contract of $699,735 by the United States Army Corps of Engineers, Omaha District, to perform weld repairs and coatings application on sixteen 40-foot-long spillway stop logs and a lifting beam at Fort Peck Dam on the Missouri River in Montana. The American Recovery and Reinvestment Act-funded contract, which required SSPC-QP 1 and QP 2 certification, includes containment of the existing lead-bearing coatings using a Class 3 containment system (SSPC-Guide 6). The steel stop logs and lifting beam will be abrasive blast-cleaned to a White Metal finish (SSPC-SP 5) and coated with a zinc-epoxy-polyurethane system.

George Kountoupes Painting Secures Tank Rehabilitation Project

George Kountoupes Painting Company (Lincoln Park, MI) secured a contract of $746,000 from the City of Newport News, VA, to rehabilitate an existing 5 MG steel ground storage tank. The project includes cleaning and recoating the interior and exterior surfaces of the 225-foot-diameter by 17-foot-top-capacity-level tank, as well as performing various repairs and modifications. The contract includes abatement of the existing lead-bearing coatings within a Class 2 containment structure (SSPC-Guide 6). The exterior surfaces will be abrasive blast-cleaned to a Commercial finish (SSPC-SP 6) and coated with an epoxy-polyurethane system; the interior surfaces will be abrasive blast-cleaned to a Near-White finish (SSPC-SP 10) and lined with an epoxy system; and the concrete foundation will be abrasive blast-cleaned (SSPC-SP 13) and coated with an epoxy system.

Pro-Tect Wins Golden Gate Bridge Containment Supply Bid

Pro-Tect Plastics and Supply, Inc. (Medford, OR) signed a 3-year term contract with the Golden Gate Bridge Highway and Transportation District to supply various containment materials, including low-density polyethylene thermoplastic film (shrink wrap) and various accessories. The materials will be used to erect Class 1W containment structures (SSPC-Guide 6) for ongoing maintenance painting to be performed by district personnel.

Washington DOT Lets Bridge Painting Project

The Washington State Department of Transportation awarded a contract of $1,584,729.57 to Long Painting Company (Kent, WA,) to recoat steel surfaces on a 557 foot-long steel bridge and a 267.5-foot-long steel bridge. The contract, which required SSPC-QP 1 and QP 2 certification, includes erecting containment to control the emission of the existing lead-bearing alkyd coating systems into the underlying waterways. The project includes cleaning and treating a total of 200 linear feet of pack rust with a rust-penetrating sealer, as well as abrasive blast-cleaning and coating the structural steel with a moisture-cured urethane system.